

NORTH AMERICAN SPECIES OF THE GENUS KOENIKEA  
(ACARINA: UNIONICOLIDAE)<sup>1</sup>

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INTRODUCTION

The first members of the genus *Koenikea* were described by Wolcott (1900) from northern United States and the type species of the genus was based on material collected in Michigan. Subsequent collecting has shown that *Koenikea* is predominantly a Neotropical group with northern United States and southern Canada at the northerly fringe of its range. Seven species (two of which are new) are presently known to occur in the north. Not surprisingly, Florida has a rather rich fauna and thirteen species or subspecies (one of which apparently also occurs in Michigan, Illinois, and Ontario) have been collected from that state. Cook (1974) described an additional species from California, bringing the total known North American forms to twenty. Conroy (1968) recorded *K. hamulata* Lundblad from British Columbia. This is a species of *Diplokoenikea* which has previously been reported only from Brazil and Paraguay. I feel the disjunct distribution makes this record suspect, and it is not included.

Wolcott (1900) described two species, *Koenikea concava* and *Tanaognathus spinipes* (*Tanaognathus* later reduced to a subgenus of *Koenikea*). The slide which Wolcott picked for the illustration of the *concava* female had two specimens on it, each belonging to a separate species (*concava* and what was to be later named *wolcotti*). Unfortunately, Wolcott chose the latter on which to base his illustrations of the female. Viets (1930) recognized that what Wolcott had called the male and female of *concava* were separate species and, utilizing Wolcott's drawings, gave the name *wolcotti* to the female. In this same paper, Viets also described two new species, *haldemani* and *marshallae*, based on material collected in northern United States. The irony of Wolcott's selection of the "female of *concava*" is not only that a true *concava* female was on the same slide, but that the specimen chosen was an extremely aberrant individual. Further study indicates that *wolcotti* and *marshallae* are conspecific. Later, Lundblad (1941) erected the subgenus *Tanaognathella* for *K. marshallae* and Lundblad (1943) described a new species, *K. alata*, based on material collected by Wolcott in Michigan.

For a more detailed discussion of the genus and subgenera, the reader is referred to Cook (1974). Subgeneric diagnoses are not included here, but some of the main subgeneric characters are included in the key which precedes the species descriptions. In presenting measurements, unless otherwise stated at the beginning of the description of a species, those of the holotype or allotype

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are given first. If a series of specimens is available, the range of variation is given in parentheses following the measurements of the primary types. Stippling on the dorsal and ventral shield drawings indicates color patterns. One will find it extremely difficult to make a completely accurate count of the genetal acetabula, especially in those species with a large number of these structures. At the lower powers of magnification needed to give a field of view sufficiently large to keep from losing ones place during the count, it is difficult to see some of the smaller acetabula or distinguish between the inner and outer openings of the same acetabula in the ventral shield. Therefore, the numbers given in the descriptions can only approximate the true number of acetabula.

Appreciation is expressed to Drs. David Barr and Ian Smith for the opportunity to examine specimens taken by them which are part of the hydrachnid collections of the Royal Ontario Museum. Dr. Torbjörn Kronestedt loaned me the type of *K. alata* from the Lundblad Collection and Dr. John Keathly sent me the type material of *K. wolcotti* from the Marshall Collection. I am indebted to both for their kindness. Holotypes and allotypes, unless otherwise indicated, will be deposited in the Field Museum of Natural History (Chicago).

#### KEY TO THE NORTH AMERICAN SUBGENERA AND SPECIES OF KOENIKEA

1. Palp four-segmented (P-II and P-III fused but suture line slightly indicated); P-IV approximately as high as long (fig. 89); a characteristic triangular sclerite present at posterior end of capitular bay (fig. 88). . . . Subgenus Tanaognathus Wolcott . . . . . 23
- Palp five-segmented; P-IV much longer than high; no triangular sclerite at posterior end of capitular bay. . . . . 2
2. An extremely long rostrum present; capitulum attached to a short tube of soft integument producing somewhat extensible mouth-parts; anchoral process not developed and pharynx not exposed (fig. 50). . . . . Subgenus Tanaognathella Lundblad . . . . . 11
- Rostrum short or only of moderate length (fig. 26); capitulum not extensible; anchoral process well developed and the pharynx partially exposed above it when viewed laterally (figs. 20, 26). . . . . 3
3. Rostrum of moderate length (figs. 26, 36); III-Leg-4 and 5 of male with three (fig. 25) to several (fig. 31) heavy, peg-like setae placed more or less at right angles to the long axis of the segment. . . . . Subgenus Diplokoenikea Lundblad . . . . . 4
- Rostrum short (figs. 15, 20); III-Leg-4 and 5 of male lacking the peg-like setae described and illustrated above. . . . . 5
4. Central portion of dorsal shield with a distinctly delineated central depressed area (figs. 33, 35); III-Leg-4 and 5 of male with a total of six to nine peg-like setae (fig. 31).  
K. himerta, new species. . . (p. 69)
- Central portion of dorsal shield without a distinctly delineated central depressed area (figs. 28, 30); III-Leg-4 and 5 of male with a total of three peg-like setae (fig. 25).  
K. stellata, new species. . . (p. 68)

5. Male palp greatly thickened compared to the female and bearing heavy setae (compare figures 41, 42). . . Subgenus Sespekoenikea Cook. . . (only known North American species, K. expansipalpis Cook). . . . . (p. 71)  
 Male and female palps of approximately the same size; male palp not greatly thickened and not bearing heavy setae (figs. 10, 20) . . . . 6

Key to the species of the subgenus *Koenikea*

6. Dorsal shield with a pair of apophyses laterally near middle and a median apophysis at anterior end (fig. 2); P-IV of palp with a ventral peg-like seta which is placed well back of the distal end (figs. 4, 10). . . . . K. concava species-group . . . . 7  
 Dorsal shield with two pairs of apophyses, one anterior pair and one middle pair (fig. 16); P-IV with a peg-like seta at extreme distal end (figs. 15, 20). . . . . K. haldemani species-group . . . . 9
7. Color pattern of dorsal shield divided into right and left patches (fig. 12). . . . . K. arpeda, new species . (p. 65)  
 Color patterns on dorsal shield meeting medially (figs. 2, 11). . . . . 8
8. Thirty or more genital acetabula on each side; acetabular plates extending well lateral to insertions of the fourth legs (figs. 1, 5); body more or less rounded. . . . . K. concava Wolcott . . (p. 63)  
 Eighteen to 25 acetabula on each side; acetabular plates extending only slightly lateral to insertions of fourth legs (figs. 7, 8); body outline angular. . . . . K. angulata, new species . (p. 64)
9. Twenty-eight or more genital acetabula present on each side; acetabular plates extending well lateral to insertions of the fourth legs (figs. 13, 14). . . . . K. haldemani Viets . . . . (p. 66)  
 Up to 26 genital acetabula present on each side; acetabular plates extending only slightly lateral to insertions of the fourth legs (figs. 18, 24). . . . . 10
10. Swimming hairs on fourth legs longer than the following leg segment; dorsal shield with a characteristic color pattern (fig. 19). . . . . K. platama, new species. . (p. 67)  
 Swimming hairs on fourth legs shorter than the following leg segment; dorsal shield with a characteristic color pattern (fig. 23). . . . . K. vidua, new species . . . (p. 68)

Key to the species of the subgenus *Tanaognathella*

11. Gonopore typically 30 $\mu$  or less in width (key to males). . . . . 12  
 Gonopore typically 100 $\mu$  or more in width (key to females) . . . . . 17
12. Distal end of II-Leg-5 with several short, thickened setae (fig. 56). . . . . 13  
 Distal end of II-Leg-5 with one (fig. 55) or no (fig. 54) thickened setae. . . . . 14

13. P-III only slightly shorter than P-IV (fig. 48); rostrum only slightly longer than the main part of the capitulum (fig. 67).  
*K. alata* Lundblad . . . . . (p. 75)  
 P-II much shorter than P-IV; rostrum much longer than the main part of the capitulum (fig. 63). . . *K. evida*, new species. . . . . (p. 76)
14. Heaviest seta on ventral side of II-Leg-5 placed at distal end (fig. 55); capitular bay V-shaped (fig. 59).  
*K. aphaesta*, new species . . . . . (p. 77)  
 Heaviest seta on ventral side of II-Leg-5 subterminal (fig. 54); capitular bay Y-shaped (fig. 75) . . . . . 15
15. Dorsal shield wider than long; segments of III-Leg-4 and 5 comparatively narrow (fig. 80). . *K. icota*, new species . . . . . (p. 74)  
 Dorsal shield longer than wide; segments of III-Leg-4 and 5 comparatively stockier (figs. 49, 74). . . . . 16
16. Acetabular plates extending laterally well beyond the insertions of the fourth legs; genital acetabula 38-48 on each side.  
*K. wolcotti* Viets . . . . . (p. 72)  
 Acetabular plates extending laterally approximately even with insertions of fourth legs; genital acetabula 20-29 on each side.  
*K. elaphra*, new species . . . . . (p. 73)
17. Palps very stocky and peg-like seta of P-IV relatively long (figs. 79, 85); fourth coxae touching medially (figs. 82, 83). . . . . 18  
 Palps less stocky and peg-like seta on P-IV proportionally shorter (figs. 50, 72, 76); fourth coxae not touching medially (figs. 44, 52) . . . . . 19
18. Genital field abruptly angled posteriorly where it joins the ventral shield (fig. 82); P-V relatively sharp-pointed (fig. 79).  
*K. connata*, new species . . . . . (p. 78)  
 Genital field not abruptly angled posteriorly where it joins the ventral shield (fig. 83); P-V relatively blunt at distal end (fig. 85) . . . . . *K. smithi*, new species . . . . . (p. 79)
19. Capitular bay somewhat Y-shaped (narrow posteriorly, then abruptly widening anteriorly -- figs. 44, 66, 77) . . . . . 20  
 Capitular bay somewhat V-shaped (figs. 52, 58, 65) . . . . . 22
20. Dorsal shield nearly as wide as long (fig. 78); acetabular plates not extending laterally as far as insertions of fourth legs (fig. 77) . . . . . *K. icota*, new species . . . . . (p. 74)  
 Dorsal shield noticeably longer than wide; acetabular plates extending even with or beyond the insertions of the fourth legs (figs. 44, 66) . . . . . 21
21. Thirty-eight to 44 genital acetabula on each side.  
*K. wolcotti* Viets . . . . . (p. 72)  
 Twenty to 25 genital acetabula on each side.  
*K. elaphra*, new species . . . . . (p. 73)

22. Capitular bay very deep, extending posteriorly nearly in a line with epimeroglandularia 1 (fig. 65). *K. evida*, new species . . . (p. 76)  
 Capitular bay much shallower, not extending nearly as far back as the epimeroglandularia 1 (fig. 52). *K. aphраста*, new species. . (p. 77)

Key to the species of the subgenus *Tanaognathus*

23. Dorsal shield wider than long; I-Leg-5 and 6 of male relatively narrow (fig. 95). . . . . *K. floridensis*, new species . . . . . (p. 81)  
 Dorsal shield longer than wide; I-Leg-5 and 6 of male relatively stocky (figs. 90, 94) . . . . . 24
24. Genital acetabula numerous (32-69 on each side in the male, 47-68 on each side in the female); no distinct color pattern on the dorsum. . . . . *K. spinipes spinipes* Wolcott . . . . . (p. 80)  
 Genital acetabula fewer in number (30-34 on each side in the male, 28-43 on each side in the female); a distinct color pattern on the dorsal shield (fig. 92). *K. spinipes carella*, new subspecies. . . (p. 80)

SPECIES DESCRIPTIONS

1. *Koenikea* (*Koenikea*) *concava* Wolcott

(Figures 1, 2, 5, 17)

*Koenikea concava* Wolcott, 1900. Trans. Amer. Microsc. Soc., 21: 190.  
 (male only, female = *K. wolcotti*)

*Koenikea concava* Wolcott, 1905. *op. cit.*, 26: 196.

*Koenikea concava* Viets, 1930. Zool. Anz., 92: 268.

*Koenikea concava* Marshall, 1935. Trans. Wisconsin Acad. Sci., 29: 274.

*Koenikea concava* Lundblad, 1943. K. Svenska Vetenskap. Handl., 20(5): 13.

*Koenikea concava* Conroy, 1968. Nat. Mus. Canada Bull. 223 (Zool. 4): 30.

Male: Dorsal shield 570 $\mu$ -638 $\mu$  in length, 540 $\mu$ -577 $\mu$  in width; edges of dorsal shield slightly irregular; dorsal shield bearing six pairs of glandularia, middle group of which are usually arranged more or less in a straight line on their respective sides; dorsal shield with a pair of lateral apophyses near middle and a single median apophysis anteriorly; color pattern typically consisting of a median band with anterolateral extensions as shown for the female (fig. 2); ventral shield 616 $\mu$ -692 $\mu$  in length, 593 $\mu$ -631 $\mu$  in width; tips of first coxae more or less rounded; capitular bay of moderate width; acetabular plate region 334 $\mu$ -380 $\mu$  in width; gonopore 45 $\mu$ -58 $\mu$  in length; acetabular plates extending well lateral to the insertions of the fourth legs; genital acetabula 38-46 on each side, these surrounding a pair of glandularia; acetabular plate region somewhat indented posteriorly in the region of these glandularia; figure 5 illustrates the proportions of the ventral shield; dorsal lengths of the palpal segments: P-I, 22 $\mu$ -26 $\mu$ ; P-II, 64 $\mu$ -76 $\mu$ ; P-III, 36 $\mu$ -41 $\mu$ ; P-IV, 59 $\mu$ -62 $\mu$ ; P-V, 38 $\mu$ -41 $\mu$ ; structure of the palp as shown for the female; rostrum short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 89 $\mu$ -93 $\mu$ ; I-Leg-5, 107 $\mu$ -118 $\mu$ ; I-Leg-6, 126 $\mu$ -144 $\mu$ ; a few swimming hairs present on all legs.

Female: Dorsal shield 638 $\mu$ -714 $\mu$  in length, 562 $\mu$ -668 $\mu$  in width; dorsal shield as described for the male (fig. 2); ventral shield 715 $\mu$ -790 $\mu$  in length,

658 $\mu$ -760 $\mu$  in width; tips of first coxae rounded; capitular bay relatively wide; acetabular plate region 350 $\mu$ -418 $\mu$  in width; gonopore 96 $\mu$ -118 $\mu$  in width; genital acetabula 30-50 on each side, these surrounding a pair of glandularia, acetabular plate region not indented posteriorly in region of these glandularia; figure 1 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I, 23 $\mu$ -27 $\mu$ ; P-II, 76 $\mu$ -81 $\mu$ ; P-III, 41 $\mu$ -45 $\mu$ ; P-IV, 62 $\mu$ -66 $\mu$ ; P-V, 38 $\mu$ -42 $\mu$ ; figure 17 shows the proportions and chaetotaxy of the palp and capitulum; dorsal lengths of the distal segments of the first leg: I-Leg-4, 91 $\mu$ -103 $\mu$ ; I-Leg-5, 104 $\mu$ -115 $\mu$ ; I-Leg-6, 122 $\mu$ -131 $\mu$ ; swimming hairs as described for the male.

Habitat and Distribution: Known from both lakes and permanent ponds. It has previously been reported by Marshall (1935) from Wisconsin, Michigan, Indiana, Illinois, Iowa, Florida and Louisiana (but these last two records may be in error, the specimens actually belonging to one of the following two species). I have seen specimens from Minnesota, Montana, New York, Ontario and Georgia. Conroy (1968) reports this species from Manitoba.

Discussion: *K. concava*, the type species of the genus *Koenikea*, differs from the two previously undescribed North American members of its species group (*angulata*, *arpeda*) as follows: It differs from *angulata* in its wider acetabular plates and greater number of acetabula (30-56 on each side in *concava*, 14-26 in *angulata*). Also, the body of the present species tends to be less angular. In general, the color patterns of these two species tend to be very distinctive (figs. 2, 11), but I have occasional specimens of *concava* in which the pigment extends more posteriorly than shown in figure 2. *K. concava* differs from *K. arpeda* in being larger and in having the dorsal pigment patch joined medially (compare figures 2, 12).

## 2. Koenikea (Koenikea) angulata, new species

(Figures 7-11)

Male: Dorsal shield 608 $\mu$  (562 $\mu$ -669 $\mu$ ) in length, 577 $\mu$  (525 $\mu$ -638 $\mu$ ) in width; edges of dorsal shield somewhat irregular; dorsal shield bearing six pairs of glandularia, middle group of which are typically arranged in a straight line on each side; dorsal shield with a lateral pair of apophyses near the middle and a single median apophysis anteriorly; color pattern typically as shown for the female (fig. 11); ventral shield 649 $\mu$  (608 $\mu$ -699 $\mu$ ) in length, 631 $\mu$  (573 $\mu$ -698 $\mu$ ) in width; tips of first coxae more or less rounded; capitular bay of moderate width; acetabular plate region 288 $\mu$  (266 $\mu$ -304 $\mu$ ) in width; gonopore 53 $\mu$  (48 $\mu$ -54 $\mu$ ) in length; acetabular plates extending laterally slightly beyond the insertions of the fourth legs; genital acetabula 18-25 on each side, these surrounding a pair of glandularia; acetabular plate region somewhat indented posteriorly in region of these glandularia; edges of ventral shield decidedly angular (fig. 8); dorsal lengths of the palpal segments: P-I, 24 $\mu$  (21 $\mu$ -25 $\mu$ ); P-II, 69 $\mu$  (65 $\mu$ -78 $\mu$ ); P-III, 35 $\mu$  (34 $\mu$ -41 $\mu$ ); P-IV, 59 $\mu$  (56 $\mu$ -64 $\mu$ ); P-V, 34 $\mu$  (34 $\mu$ -38 $\mu$ ); a peg-like seta inserted on ventral side of P-IV well back from distal end; rostrum short; dorsal lengths of the distal segments of the first leg: I-Leg-4, 89 $\mu$  (81 $\mu$ -96 $\mu$ ); I-Leg-5, 107 $\mu$  (96 $\mu$ -122 $\mu$ ); I-Leg-6, 126 $\mu$  (116 $\mu$ -148 $\mu$ ); all legs with a few swimming hairs.

Female: Dorsal shield 677 $\mu$  (608 $\mu$ -698 $\mu$ ) in length, 642 $\mu$  (577 $\mu$ -642 $\mu$ ) in width; dorsal shield as described for the male (fig. 11); ventral shield 733 $\mu$  (684 $\mu$ -775 $\mu$ ) in length, 714 $\mu$  (653 $\mu$ -744 $\mu$ ) in width; tips of first coxae rounded; capitular bay relatively wide; acetabular plate region 364 $\mu$  (304 $\mu$ -364 $\mu$ ) in

width; gonopore  $103\mu$  ( $98\mu$ - $103\mu$ ) in width; acetabular plates extending laterally somewhat beyond insertions of fourth legs; genital acetabula 20-24 on each side, these surrounding a pair of glandularia; acetabular plate region somewhat indented posteriorly in region of these glandularia; figure 7 illustrates the ventral shield; dorsal lengths of the palpal segments: P-I,  $25\mu$  ( $24\mu$ - $26\mu$ ); P-II,  $72\mu$  ( $68\mu$ - $79\mu$ ); P-III,  $38\mu$  ( $35\mu$ - $44\mu$ ); P-IV,  $62\mu$  ( $59\mu$ - $69\mu$ ); P-V,  $37\mu$  ( $36\mu$ - $38\mu$ ); palp and capitulum as illustrated for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $90\mu$  ( $78\mu$ - $92\mu$ ); I-Leg-5,  $109\mu$  ( $96\mu$ - $111\mu$ ); I-Leg-6,  $118\mu$  ( $112\mu$ - $122\mu$ ); all legs with a few swimming hairs.

Holotype: Adult  $\sigma$ , collected in a pond beside State Highway 51, three miles north of Clara, Lafayette County, Florida, November 10, 1970.

Allotype: Adult  $\text{♀}$ , same data as holotype.

Paratypes: Six  $\sigma\sigma$ , 3  $\text{♀♀}$ , same data as holotype; 3  $\sigma\sigma$ , from Lake Tsala Apopka on Highway 44 east of Inverness, Citrus County, Florida, November 11, 1970; 1  $\text{♀}$ , from the same locality, December 21, 1955; 1  $\sigma$ , taken in a pond in Pinellas County, Florida, April 10, 1950; 3  $\sigma\sigma$ , 4  $\text{♀♀}$ , from a pond in Pinellas County, Florida, December 24, 1955; 3  $\sigma\sigma$ , 1  $\text{♀}$ , collected in a small pond at the side of Highway 37 (slightly south of the Hillsborough County line), Manatee County, Florida, November 12, 1970; 1  $\sigma$ , from a sluggish stream at Bridge 40 on Highway US 41, Collier County, Florida, November 14, 1970; 1  $\sigma$ , 1  $\text{♀}$ , from an artificial pond beside Highway 29 one mile north of Immokalee, Collier County, Florida, November 16, 1970; 1  $\text{♀}$ , taken in the Tamiami Canal near the Collier County line, Dade County, Florida, November 14, 1970; 1  $\sigma$ , 1  $\text{♀}$ , collected in a pond near New Bern, Craven County, North Carolina, July 5, 1953.

Discussion: The angular body, relatively few genital acetabula, and characteristic color pattern of the dorsum (fig. 11) will distinguish the present species from other members of its species group.

### 3. Koenikea (Koenikea) arpeda, new species

(Figures 3, 4, 6, 12)

Female: Dorsal shield  $555\mu$  in length,  $486\mu$  in width; edges of dorsal shield irregular; dorsal shield bearing six pairs of glandularia, the middle group of which are arranged in a triangle on each side; dorsal shield with a lateral pair of apophyses near middle and a single median apophysis anteriorly; color pattern separated into right and left portions (fig. 12); ventral shield  $638\mu$  in length,  $593\mu$  in width; tips of first coxae rounded; capitular bay of moderate width; acetabular plate region  $289\mu$  in width; gonopore  $94\mu$  in width; acetabular plates extending slightly lateral to the insertions of the fourth legs; genital acetabula 31-34 on each side, these surrounding a pair of glandularia; acetabular plate region indented posteriorly in the region of these glandularia; no color pattern on ventral shield; dorsal lengths of the palpal segments: P-I,  $24\mu$ ; P-II,  $69\mu$ ; P-III,  $40\mu$ ; P-IV,  $54\mu$ ; P-V,  $34\mu$ ; ventral side of P-IV with distally directed projection (fig. 4); dorsal lengths of the distal segments of the first leg: I-Leg-4,  $68\mu$ ; I-Leg-5,  $81\mu$ ; I-Leg-6,  $103\mu$ ; these segments somewhat thickened (fig. 3); all legs with a few swimming hairs.

Male: Unknown.

Holotype: Adult  $\text{♀}$ , collected in the Withlacoochee River (beside Highway US 84 at Brooks County border), Lowndes County, Georgia, September 13, 1968.

Discussion: The present species differs from other North American members of the *concava*-group in being much smaller and in having the color pattern

divided into right and left halves on the dorsal shield (fig. 12) and completely absent on the ventral shield. It also differs from *angulata* in lacking an angular body and in its more numerous genital acetabula. The present species also differs from *concava* in that the acetabular plate region does not extend as far laterally.

#### 4. Koenikea (Koenikea) haldemani Viets

(Figures 13-16)

*Koenikea haldemani* Viets, 1930. Zool. Anz., 92: 268.

*Koenikea haldemani* Marshall, 1935. Trans. Wisconsin Acad. Sci., 29: 275.

*Koenikea haldemani* Conroy, 1968. Nat. Mus. Canada Bull. No. 223 (Zool. IV) p. 30.

Male: Dorsal shield  $465\mu$ - $509\mu$  in length,  $425\mu$ - $502\mu$  in width; dorsal shield bearing six pairs of glandularia; middle glandularia group arranged more or less in a straight line on their respective sides as shown for the female; two pairs of prominent apophyses present; color pattern of dorsum typically as illustrated for the female; ventral shield  $494\mu$ - $562\mu$  in length,  $465\mu$ - $547\mu$  in width; edges of ventral shield often irregular (fig. 14); tips of first coxae somewhat pointed; capitular bay relatively wide; acetabular plate region  $297\mu$ - $350\mu$  in width; gonopore small and appearing foreshortened in ventral view; acetabular plates extending well lateral to insertions of fourth legs; genital acetabula 28-43 on each side, these surrounding a pair of glandularia; acetabular plate region indented posteriorly in region of these glandularia; figure 14 shows the morphology and typical color pattern of the ventral shield; dorsal lengths of the palpal segments: P-I,  $17\mu$ - $18\mu$ ; P-II,  $83\mu$ - $96\mu$ ; P-III,  $41\mu$ - $44\mu$ ; P-IV,  $66\mu$ - $71\mu$ ; P-V,  $30\mu$ - $31\mu$ ; structure of palp as described and illustrated for the female; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $105\mu$ - $115\mu$ ; I-Leg-5,  $133\mu$ - $142\mu$ ; I-Leg-6,  $142\mu$ - $146\mu$ ; all legs with swimming hairs but those of the first leg shortened.

Female: Dorsal shield  $525\mu$ - $623\mu$  in length,  $486\mu$ - $604\mu$  in width, color pattern and muscle scars of dorsal shield illustrated in figure 16; ventral shield  $577\mu$ - $653\mu$  in length,  $562\mu$ - $638\mu$  in width; tips of first coxae somewhat pointed; capitular bay of moderate width; acetabular plate region  $373\mu$ - $449\mu$  in width; gonopore  $94\mu$ - $103\mu$  in width; acetabular plates extending well lateral to the insertions of the fourth legs; genital acetabula 30-39 on each side, these surrounding a pair of glandularia; acetabular plates indented posteriorly in the region of these glandularia; figure 13 shows the morphology and typical color pattern of the ventral shield; dorsal lengths of the distal segments: P-I,  $17\mu$ - $20\mu$ ; P-II,  $93\mu$ - $110\mu$ ; P-III,  $48\mu$ - $59\mu$ ; P-IV,  $74\mu$ - $86\mu$ ; P-V,  $36\mu$ - $40\mu$ ; a small peg-like seta located at distoventral end of medial surface of P-IV; figure 15 shows a lateral view of the capitulum and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $111\mu$ - $140\mu$ ; I-Leg-5,  $133\mu$ - $162\mu$ ; I-Leg-6,  $141\mu$ - $155\mu$ ; swimming hairs as in male.

Habitat and Distribution: This is a lake and pond inhabiting species which is presently known from Northeastern and Northcentral United States and Ontario. Specifically, it has been taken in Michigan, Wisconsin, Minnesota, Iowa and New York in the United States. Conroy (1968) lists it from British Columbia. Habeeb (1967) reports this species from the Sespe River in Ventura County, California. However, there seems little question but this is a misidentification, and that the California specimens belong in *K. expansipalpis* Cook.



Discussion: *K. haldemani* differs from the other two North American members of its species group (*platama* and *vidua*) in its more widely extending acetabular plates and more numerous acetabula. Figure 16 shows the typical color pattern of the dorsum. However, I have seen a few specimens in which this color patch is somewhat smaller and one individual in which it was expanded to occupy all of the dorsal shield. The ventral shield was also completely dark in the latter individual.

5. Koenikea (Koenikea) platama, new species

(Figures 18-21)

Male: Dorsal shield  $449\mu$  ( $426\mu$ - $449\mu$ ) in length,  $425\mu$  ( $410\mu$ - $425\mu$ ) in width; dorsal shield bearing six pairs of glandularia, the middle group of which are arranged more or less in a straight line as in the female (fig. 19); two pairs of apophyses present, but anterior pair only moderately developed (compared with other members of the species group); color pattern on dorsum as illustrated for the female; ventral shield  $471\mu$  ( $456\mu$ - $477\mu$ ) in length,  $460\mu$  ( $456\mu$ - $471\mu$ ) in width; edges of ventral shield tending to be irregular; tips of first coxae somewhat pointed; capitular bay wide; acetabular plate region  $266\mu$  ( $258\mu$ - $266\mu$ ) in width; gonopore small and somewhat foreshortened in ventral view; acetabular plates extending slightly lateral to the insertions of the fourth legs; genital acetabula varying from 14-16 on each side, these surrounding a pair of glandularia; acetabular plates indented posteriorly in the region of these glandularia; figure 18 shows the morphology of the venter; dorsal lengths of the palpal segments: P-I,  $17\mu$  ( $16\mu$ - $17\mu$ ); P-II,  $86\mu$  ( $86\mu$ - $88\mu$ ); P-III,  $40\mu$  ( $38\mu$ - $41\mu$ ); P-IV,  $64\mu$  ( $61\mu$ - $66\mu$ ); P-V,  $28\mu$  ( $28\mu$ - $30\mu$ ); a small peg-like seta located at distoventral end of medial surface of P-IV; figure 20 shows the proportions and chaetotaxy of the palp and capitulum; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $103\mu$  ( $101\mu$ - $113\mu$ ); I-Leg-5,  $129\mu$  ( $124\mu$ - $140\mu$ ); I-Leg-6,  $148\mu$  ( $126\mu$ - $148\mu$ ); all legs with a few swimming hairs, but those of the first leg shortened; swimming hairs of fourth leg longer than the following segment.

Female: Dorsal shield  $486\mu$  ( $460\mu$ - $516\mu$ ) in length,  $452\mu$  ( $426\mu$ - $490\mu$ ) in width; color pattern of dorsum consisting of anterior and posterior median patches and a very characteristically-shaped, wide middle blotch (fig. 19); ventral shield  $555\mu$  ( $502\mu$ - $577\mu$ ) in length,  $521\mu$  ( $502\mu$ - $550\mu$ ) in width; tips of first coxae somewhat pointed; capitular bay of moderate width; acetabular plate region  $289\mu$  ( $289\mu$ - $334\mu$ ) in width; gonopore  $92\mu$  ( $92\mu$ - $96\mu$ ) in width; acetabular plates extending slightly lateral to insertions of the fourth legs; genital acetabula 15-26 on each side, these surrounding a pair of glandularia; acetabular region indented posteriorly in region of these glandularia; figure 21 shows the morphology and typical color pattern of the ventral shield; dorsal lengths of the palpal segments: P-I,  $19\mu$  ( $19\mu$ - $21\mu$ ); P-II,  $95\mu$  ( $88\mu$ - $95\mu$ ); P-III,  $41\mu$  ( $40\mu$ - $46\mu$ ); P-IV,  $73\mu$  ( $69\mu$ - $75\mu$ ); P-V,  $37\mu$  ( $34\mu$ - $37\mu$ ); structure of the palp as described for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $111\mu$  ( $107\mu$ - $122\mu$ ); I-Leg-5,  $139\mu$  ( $137\mu$ - $148\mu$ ); I-Leg-6,  $133\mu$  ( $133\mu$ - $141\mu$ ); swimming hairs as in the male.

Holotype: Adult ♂, collected in an artificial pond beside Highway 29 one mile north of Immokalee, Collier County, Florida, November 16, 1970.

Allotype: Adult ♀, same data as holotype.

Paratypes: One ♂, 1 ♀, same data as holotype; 1 ♂, 1 ♀, from the Tamiami Canal near the Collier County line, Dade County, Florida, November 14, 1970;

1 ♀, from the backwater area of a stream two miles north of Douglas, Coffee County, Georgia, September 12, 1968.

Discussion: The present species differs from other North American members of its species group (*haldemani*, *vidua*) in being slightly smaller, having the anterior pair of dorsal shield apophyses less developed, tending to have fewer acetabula, and in its very characteristic color pattern of the dorsum (fig. 19).

6. Koenikea (Koenikea) vidua, new species

(Figures 22-24)

Male: Dorsal shield  $471\mu$  ( $471\mu$ - $516\mu$ ) in length,  $418\mu$  ( $418\mu$ - $486\mu$ ) in width; dorsal shield bearing six pairs of glandularia; middle glandularia group located more or less in a straight line on their respective sides; both the anterior and posterior pair of apophyses well developed; color pattern of dorsum consisting of a middle dark blue patch with orange color anteriorly and posteriorly (fig. 23); ventral shield  $509\mu$  ( $509\mu$ - $547\mu$ ) in length,  $456\mu$  ( $456\mu$ - $532\mu$ ) in width; edges of ventral shield tending to be smooth, not irregular as in males of the two related species; tips of first coxae somewhat pointed; capitular bay wide; acetabular plate region  $243\mu$  ( $243\mu$ - $258\mu$ ) in width; gonopore small and somewhat foreshortened in ventral view; acetabular plates extending slightly lateral to the insertions of the fourth legs; genital acetabula 19-21 on each side, these surrounding a pair of glandularia; acetabular plates indented posteriorly in the region of these glandularia; figure 24 shows the proportions of the ventral shield; dorsal lengths of the palpal segments: P-I,  $21\mu$  ( $18\mu$ - $21\mu$ ); P-II,  $103\mu$  ( $103\mu$ - $107\mu$ ); P-III,  $46\mu$  ( $46\mu$ - $52\mu$ ); P-IV,  $76\mu$  ( $73\mu$ - $76\mu$ ); P-V,  $31\mu$  ( $29\mu$ - $31\mu$ ); a small peg-like seta located at distoventral end of medial surface of P-IV; figure 22 shows the proportions and chaetotaxy of the palp and capitulum; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $111\mu$  ( $105\mu$ - $120\mu$ ); I-Leg-5,  $131\mu$  ( $131\mu$ - $137\mu$ ); I-Leg-6,  $133\mu$  ( $126\mu$ - $136\mu$ ); swimming hairs on all legs but these relatively short; none of the swimming hairs on the fourth leg longer than the following segment.

Female: Unknown.

Holotype: Adult ♂, collected in the Tamiami Canal near the Collier County line, Dade County Florida, November 14, 1970.

Paratypes: Two ♂♂, same data as holotype.

Discussion: The present species (known from the male only) differs from *haldemani* and *platama* in the length of the swimming hairs, none of which are longer than the following segment. In the other two species the swimming hairs of IV-Leg-3, 4 and 5 are longer than the respective following segments. *A. vidua* also differs in possessing a relatively smooth margin of the ventral shield in the male and in its characteristic dorsal color pattern as described above. The genital field of *vidua* is much smaller and bears fewer acetabula than in *haldemani*.

7. Koenikea (Diplokoenikea) stellata, new species

(Figures 25-30)

Male: Dorsal shield  $372\mu$  ( $350\mu$ - $380\mu$ ) in length,  $380\mu$  ( $369\mu$ - $403\mu$ ) in width; dorsal shield decidedly angular and slightly wider than long; dorsal shield bearing six pairs of glandularia, middle glandularia group located more

or less in a straight line on each side; dorsal shield with a pair of lateral apophyses slightly posterior to middle; color pattern of dorsum forming a five-rayed pattern as shown in figure 28; ventral shield  $395\mu$  ( $373\mu$ - $395\mu$ ) in length,  $410\mu$  ( $410\mu$ - $433\mu$ ) in width; body decidedly angular, tips of first coxae rounded; capitular bay wide; acetabular plate region  $155\mu$  ( $148\mu$ - $170\mu$ ) in width; gonopore relatively long,  $59\mu$  ( $55\mu$ - $59\mu$ ) in length; genital acetabula 11-14 on each side, these surrounding a pair of glandularia; acetabular plates not indented posteriorly; figure 27 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $24\mu$  ( $23\mu$ - $25\mu$ ); P-II,  $85\mu$  ( $76\mu$ - $85\mu$ ); P-III,  $38\mu$  ( $35\mu$ - $38\mu$ ); P-IV,  $66\mu$  ( $61\mu$ - $66\mu$ ); P-V,  $40\mu$  ( $38\mu$ - $40\mu$ ); a small peg-like seta located on a slightly raised tubercle on ventral side of P-IV near distal end; capitulum with a moderately developed rostrum; figure 26 shows the proportions and chaetotaxy of the palp and capitulum; dorsal lengths of the distal segments of the third leg: III-Leg-4,  $100\mu$  ( $96\mu$ - $100\mu$ ); III-Leg-5,  $108\mu$  ( $100\mu$ - $109\mu$ ); III-Leg-6,  $108\mu$  ( $102\mu$ - $113\mu$ ); III-Leg-4 with one peg-like seta, III-Leg-5 with two peg-like setae (fig. 25); third and fourth legs with a few long swimming hairs.

Female: Dorsal shield  $508\mu$  ( $499\mu$ - $547\mu$ ) in length,  $441\mu$  ( $441\mu$ - $486\mu$ ) in width; dorsal shield oval but otherwise as described for the male (fig. 30); ventral shield  $547\mu$  ( $547\mu$ - $593\mu$ ) in length,  $510\mu$  ( $510\mu$ - $547\mu$ ) in width; tips of first coxae rounded; capitular bay relatively wide; acetabular plates short, acetabular plate region  $210\mu$  ( $210\mu$ - $229\mu$ ) in width; gonopore  $96\mu$  ( $96\mu$ - $107\mu$ ) in width; genital acetabula 11-19 on each side, these surrounding a pair of glandularia; acetabular plate region not indented posteriorly; figure 29 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I,  $25\mu$  ( $24\mu$ - $27\mu$ ); P-II,  $91\mu$  ( $90\mu$ - $93\mu$ ); P-III,  $40\mu$  ( $39\mu$ - $41\mu$ ); P-IV,  $69\mu$  ( $66\mu$ - $71\mu$ ); P-V,  $42\mu$  ( $41\mu$ - $43\mu$ ); structure of palp and capitulum as illustrated for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $96\mu$  ( $96\mu$ - $101\mu$ ); I-Leg-5,  $99\mu$  ( $99\mu$ - $100\mu$ ); I-Leg-6,  $92\mu$  ( $92\mu$ - $99\mu$ ); second, third and fourth legs with a few long swimming hairs.

Holotype: Adult ♂, collected in Lake Tsala Apopka on Highway 44 east of Inverness, Citrus County, Florida, November 11, 1970.

Allotype: Adult ♀, same data as holotype.

Paratypes: Four ♂♂, 5 ♀♀, same data as holotype; 1 ♀, same area on April 9, 1950; 1 ♀, from a canal beside Highway US 1 south of Homestead, Dade County, Florida, April 14, 1950.

Discussion: *K. stellata* and the following species, *K. himerta*, are the first members of the subgenus *Diplokoenikea* reported from North America. The present species differs from *himerta* in lacking a well developed, depressed central area in the dorsal shield (compare figures 28, 33). Also, the male gonopore is proportionally much longer in *stellata* and III-Leg-4 and 5 bear fewer peg-like setae (compare figures 25, 31).

#### 8. Koenikea (Diplokoenikea) himerta, new species

(Figures 31-36)

Male: Dorsal shield  $540\mu$  ( $502\mu$ - $540\mu$ ) in length,  $570\mu$  ( $517\mu$ - $570\mu$ ) in width; dorsal shield somewhat triangular and slightly wider than long; dorsal shield bearing six pairs of glandularia, the two most lateral pairs of which are very close together on their respective sides and located on somewhat raised tubercles; dorsal shield with a distinctly delineated, depressed central area and a pair of well developed apophyses; figure 33 illustrates the structure and

color pattern of the dorsal shield; ventral shield  $578\mu$  ( $555\mu$ - $578\mu$ ) in length,  $601\mu$  ( $562\mu$ - $601\mu$ ) in width; body distinctly angular; tips of first coxae rounded; capitular bay wide; acetabular plate region  $295\mu$  ( $282\mu$ - $295\mu$ ) in width; gonopore  $46\mu$  ( $46\mu$ - $50\mu$ ) in length; genital acetabula 16-19 on each side, these surrounding a pair of glandularia; figure 32 illustrates the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I,  $30\mu$  ( $30\mu$ - $31\mu$ ); P-II,  $85\mu$  ( $85\mu$ - $87\mu$ ); P-III,  $38\mu$  ( $36\mu$ - $38\mu$ ); P-IV,  $71\mu$  ( $69\mu$ - $71\mu$ ); P-V,  $39\mu$  ( $39\mu$ - $41\mu$ ); a small peg-like seta located on a slightly raised tubercle on the ventral side of P-IV near distal end; capitulum with a moderately developed rostrum; figure 36 shows the proportions and chaetotaxy of the palp and capitulum; dorsal lengths of the distal segments of the third leg: III-Leg-4,  $146\mu$  ( $137\mu$ - $146\mu$ ); III-Leg-5,  $170\mu$  ( $159\mu$ - $170\mu$ ); III-Leg-6,  $155\mu$  ( $148\mu$ - $155\mu$ ); III-Leg-4 bearing four to six peg-like setae on ventral side, III-Leg-5 bearing two or three peg-like setae on ventral side; figure 31 shows these segments; all legs with swimming hairs, but those on the first leg reduced to a single seta of moderate length on segments four and five.

Female: Dorsal shield  $646\mu$  ( $630\mu$ - $744\mu$ ) in length,  $586\mu$  ( $586\mu$ - $684\mu$ ) in width; dorsal shield somewhat oval but otherwise much as described for the male (fig. 35); ventral shield length  $745\mu$  ( $715\mu$ - $820\mu$ ), width  $699\mu$  ( $668\mu$ - $775\mu$ ); tips of first coxae rounded; capitular bay relatively wide; acetabular plate region  $327\mu$  ( $315\mu$ - $373\mu$ ) in width; gonopore  $102\mu$  ( $100\mu$ - $111\mu$ ) in width; genital acetabula 17-22 on each side, these surrounding a pair of glandularia; figure 34 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $31\mu$  ( $29\mu$ - $34\mu$ ); P-II,  $97\mu$  ( $92\mu$ - $100\mu$ ); P-III,  $45\mu$  ( $42\mu$ - $47\mu$ ); P-IV,  $76\mu$  ( $72\mu$ - $80\mu$ ); P-V,  $43\mu$  ( $39\mu$ - $44\mu$ ); morphology of palp and capitulum similar to that illustrated for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $126\mu$  ( $115\mu$ - $129\mu$ ); I-Leg-5,  $140\mu$  ( $133\mu$ - $147\mu$ ); I-Leg-6,  $120\mu$  ( $120\mu$ - $126\mu$ ); swimming hairs as described for the male.

Holotype: Adult ♂, found in a pond beside State Highway 51, three miles north of Clara, Lafayette County, Florida, November 10, 1970.

Allotype: Adult ♀, found in a sluggish stream at Bridge 40 on Highway US 41, Collier County, Florida, November 14, 1970.

Paratypes: One ♀, from a lily pond beside Highway 72, approximately 3.5 miles west of entrance to Myakka River State Park, Sarasota County, Florida, November 13, 1970; 1 ♀, same data as allotype; 1 ♂, taken in the Tamiami Canal near the Collier County line, Dade County, Florida, November 14, 1970; 1 ♀, from a roadside canal on Highway 27 (four miles south of Highway US 41), Dade County, Florida, April 14, 1950; 1 ♀, from a roadside pool five miles west of Grower's Corners, Pasco County, Florida, April 9, 1950.

Discussion: See discussion section under the preceding species for differences between the two North American members of the subgenus *Diplokoenikea*. The present species seems most closely related to the South American species, *K. pectinifera* Lundblad, *K. clavigera clavigera* Lundblad and *K. clavigera assimilis* Lundblad (all three reported from Brazil and Paraguay). All have a somewhat similar dimorphism of the male third leg and color pattern of the dorsal shield. The new species differs most noticeably from *clavigera* and its subspecies in that the male dorsal shield is more or less triangular (fig. 33). Males of the South American forms have an almost rounded dorsal shield. The present species is most closely related to *pectinifera*, both having a somewhat triangular dorsal shield in the male. However, *K. himerta* has fewer genital acetabula and the acetabular plates extend laterally only as far as the insertions of the fourth legs (in both sexes). Also there is a difference in the sexual dimorphism of the male third leg. The peg-like setae on III-Leg-4 are stockier and placed closer together in the species from South America.

9. *Koenikea* (*Sespekoenikea*) *expansipalpis* Cook

(Figures 37-42)

*Koenikea expansipalpis* Cook, 1974. Mem. Amer. Ent. Inst., 21: 450.

Male: Dorsal shield  $471\mu$ - $520\mu$  in length,  $440\mu$ - $502\mu$  in width; dorsal shield somewhat angular and bearing six pairs of glandularia; middle glandularia group located more or less in a straight line on their respective sides; dorsal shield bearing two pairs of well developed apophyses (fig. 39); color pattern indistinct or absent; ventral shield  $486\mu$ - $562\mu$  in length,  $494\mu$ - $562\mu$  in width; tips of first coxae bluntly pointed; capitular bay extremely wide; acetabular plate region  $264\mu$ - $295\mu$  in width; genital acetabula 20-25 on each side; gonopore small and somewhat foreshortened in ventral view; posterior apodemes of fourth coxae very prominent; ventral surface of fourth coxae angled (this best seen in lateral view); dorsal lengths of the palpal segments: P-I,  $22\mu$ - $26\mu$ ; P-II,  $110\mu$ - $138\mu$ ; P-III,  $52\mu$ - $57\mu$ ; P-IV,  $64\mu$ - $77\mu$ ; P-V,  $27\mu$ - $31\mu$ ; palpal segments very stocky; medial portion of P-III projecting at distal end; P-II and P-III bearing greatly thickened setae (fig. 42); a small peg-like seta located at distoventral end of medial surface of P-IV; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $115\mu$ - $131\mu$ ; I-Leg-5,  $133\mu$ - $152\mu$ ; I-Leg-6,  $133\mu$ - $145\mu$ ; all legs with a few swimming hairs, but those of the first leg shortened.

Female: Dorsal shield  $570\mu$ - $638\mu$  in length,  $547\mu$ - $577\mu$  in width; except for being proportionally narrower, dorsal shield of female similar to that described for male; ventral shield  $638\mu$ - $699\mu$  in length,  $623\mu$ - $652\mu$  in width; tips of first coxae somewhat pointed; capitular bay of moderate width; acetabular plate region  $349\mu$ - $375\mu$  in width; gonopore  $98\mu$ - $110\mu$  in width; acetabular plates extending slightly lateral to insertions of the fourth legs; genital acetabula 20-30 on each side, these surrounding a pair of glandularia; figure 37 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $22\mu$ - $26\mu$ ; P-II,  $109\mu$ - $121\mu$ ; P-III,  $52\mu$ - $55\mu$ ; P-IV,  $79\mu$ - $88\mu$ ; P-V,  $41\mu$ - $45\mu$ ; none of the palpal segments greatly thickened; figure 41 shows a lateral view of the capitulum and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $121\mu$ - $133\mu$ ; I-Leg-5,  $138\mu$ - $148\mu$ ; I-Leg-6,  $128\mu$ - $140\mu$ ; swimming hairs as described for male.

Habitat and Distribution: This species was collected by stirring up bottom sand and gravel deposits in the Sespe River near Fillmore, Ventura County, California. The habitat plus the reduced color pattern suggest that the present species is primarily an interstitial form. *K. expansipalpis* is known only from the type locality.

Discussion: Habeeb (1975) has pointed out the error in spelling the river name of the type locality in the original description (it should be Sespe, not Sepse) and the consequent lapsus in the spelling of the subgeneric name. The subgenus *Sespekoenikea* appears to be a rather divergent offshoot from some *haldemani*-like ancestor, and females do not exhibit characters which would distinguish them from a member of that species-group. I have recently taken other species of this subgenus from Mexico and Costa Rica. This suggests that *Sespekoenikea* is primarily a northern Neotropical group which barely extends into our area.

10. Koenikea (Tanaognathella) wolcotti Viets

(Figures 43-47, 49, 50)

*Koenikea concava* Wolcott, 1900. Trans. Amer. Microsc. Soc., 21: 190.  
(female)

*Koenikea concava* Wolcott, 1905. op. cit., 26: 196. (female)

*Koenikea wolcotti* Viets, 1930. Zool. Anz., 92: 266.

*Koenikea marshallae* Viets, 1930. op. cit., 92: 267.

*Koenikea wolcotti* Marshall, 1935. Trans. Wisconsin Acad. Sci., 29: 275.

*Koenikea marshallae* Marshall, 1935. op. cit., 29: 276.

*Koenikea marshallae* Lundblad, 1943. K. Svenska Vetenskap. Handl., 20(5): 8.

*Koenikea wolcotti* Lundblad, 1943. op. cit., 20(5): 23.

Male: Dorsal shield  $540\mu$ - $562\mu$  in length,  $485\mu$ - $504\mu$  in width; dorsal shield bearing six pairs of glandularia; the pair of lateral apophyses usually much better developed in male than shown in the dorsal shield of the female (fig. 43); color pattern somewhat variable but typically as illustrated for the female; ventral shield  $570\mu$ - $608\mu$  in length,  $547\mu$ - $578\mu$  in width; capitular bay narrow posteriorly and then abruptly widening anteriorly; acetabular plates extending almost directly laterally, slightly beyond the insertions of the fourth legs; acetabular plate region  $297\mu$ - $319\mu$  in width; gonopore  $74\mu$ - $88\mu$  in length; genital acetabula numerous, 43-48 on each side, and these completely surrounding a pair of glandularia; figure 45 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $23\mu$ - $26\mu$ ; P-II,  $57\mu$ - $63\mu$ ; P-III,  $37\mu$ - $40\mu$ ; P-IV,  $55\mu$ - $60\mu$ ; P-V,  $30\mu$ - $32\mu$ ; capitulum with an extremely long rostrum; structure of capitulum and palp as shown for the female; heavy setae at tip of II-Leg-5 similar to that shown in figure 54; dorsal lengths of the distal segments of the third leg: III-Leg-4,  $148\mu$ - $156\mu$ ; III-Leg-5,  $162\mu$ - $173\mu$ ; III-Leg-6,  $175\mu$ - $185\mu$ ; III-Leg-4 bearing four to six short, peg-like setae on ventral side, III-Leg-5 bearing six to nine small peg-like setae on ventral side; figure 49 shows the proportions and chaetotaxy of these segments; all legs with a few swimming hairs.

Female: Dorsal shield  $653\mu$ - $760\mu$  in length,  $562\mu$ - $684\mu$  in width; figure 43 shows the structure and typical color pattern of the dorsum; ventral shield  $714\mu$ - $821\mu$  in length,  $653\mu$ - $770\mu$  in width; capitular bay as described for the male; fourth coxae separated medially; acetabular plate region  $380\mu$ - $456\mu$  in width; acetabular plates typically extending lateral to insertions of the fourth legs; genital acetabula numerous, 38-44 on each side, and these surrounding a pair of glandularia; gonopore  $111\mu$ - $129\mu$  in width; figure 44 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $24\mu$ - $28\mu$ ; P-II,  $58\mu$ - $68\mu$ ; P-III,  $43\mu$ - $48\mu$ ; P-IV,  $62\mu$ - $69\mu$ ; P-V,  $34\mu$ - $35\mu$ ; a peg-like seta present distoventrally on medial surface of P-IV; capitulum with a long, upturned rostrum; figure 50 shows a lateral view of the capitulum and palp; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $107\mu$ - $125\mu$ ; I-Leg-5,  $139\mu$ - $162\mu$ ; I-Leg-6,  $170\mu$ - $185\mu$ ; swimming hairs as described for the male.

Habitat and Distribution: The type locality of this species is in the vicinity of Grand Rapids, Michigan. It is the most common northern member of its subgenus and has been collected in lakes and permanent ponds in Michigan, Wisconsin, Minnesota, Illinois, Ontario and New York. Marshall (1935) also lists it from Louisiana, but this record should be regarded as tentative, for it more likely refers to one of the species described from Florida.

Discussion: There has been a great deal of confusion concerning the present species. As mentioned earlier, the original description of *wolcotti* by Viets (1930) was based on the illustrations in Wolcott (1900). The latter author considered it to be the female of *conca* but Viets, recognizing it could not possibly belong to that species, gave it a new name. Figure 47 was redrawn from Wolcott's illustration and shows how much shorter the rostrum is than a typical example of *Tanaognathella* (fig. 50). However, a reexamination of Wolcott's slide indicates that the type specimen has an anomalous rostrum. Figure 46 is an illustration of the palp and capitulum based on Wolcott's type slide. The capitulum is still attached to the body by the tube of soft integument but is twisted so as to present a lateral view. It is not a perfect lateral view as shown by the position of the left P-I and capitular setae (shown in broken lines). However, this does not account for the apparent shortness of the rostrum. The latter is decidedly curved to one side near the distal end and appears to be broken at the tip. The end of the rostrum does not taper to a point as illustrated by Wolcott but ends abruptly.

Viets (1930) also described *K. marshallae*, based on material sent to him from North America. However, an examination of Wolcott's slide indicates that, other than in differences in the aberrant rostrum, *wolcotti* and *marshallae* are similar and, as *wolcotti* has page priority, it becomes the valid name. Based on the relatively short rostrum (compared to typical *Tanaognathella*) illustrated by Wolcott, Lundblad (1943) suggested that *wolcotti* might belong in the subgenus *Pseudokoenikea* Lundblad. However, *wolcotti* definitely belongs in *Tanaognathella* and, indeed, is the type species for the subgenus.

Interestingly, present distributional records indicate the subgenus *Tanaognathella* is confined to North America east of the Mississippi River. This is somewhat surprising for five species occur in Florida, and it might be expected that some representative would have moved down the island chains into Venezuela or the Yucatan.

## 11. Koenikea (Tanaognathella) elaphra, new species

(Figures 54, 66, 69-72, 74)

Male: Dorsal shield  $532\mu$  ( $510\mu$ - $577\mu$ ) in length,  $517\mu$  ( $486\mu$ - $562\mu$ ) in width; dorsal shield bearing six pairs of glandularia; the pair of lateral apophyses much better developed in male than illustrated in the female; color pattern somewhat variable but often as shown for the female (fig. 69); ventral shield  $578\mu$  ( $532\mu$ - $623\mu$ ) in length,  $532\mu$  ( $532\mu$ - $620\mu$ ) in width; capitular bay narrow posteriorly and then abruptly widening anteriorly; acetabular plates extending more or less laterally (or slightly posterolaterally) approximately as far as insertions of the fourth legs; acetabular plate region  $228\mu$  ( $228\mu$ - $288\mu$ ) in width; gonopore  $74\mu$  ( $74\mu$ - $85\mu$ ) in length; genital acetabula 25-29 on each side, these completely surrounding a pair of glandularia; figure 71 illustrates a typical ventral shield; dorsal lengths of the palpal segments: P-I,  $19\mu$  ( $19\mu$ - $21\mu$ ); P-II,  $55\mu$  ( $55\mu$ - $60\mu$ ); P-III,  $38\mu$  ( $35\mu$ - $38\mu$ ); P-IV,  $52\mu$  ( $52\mu$ - $56\mu$ ); P-V,  $30\mu$  ( $30\mu$ - $33\mu$ ); capitulum similar to that illustrated for *wolcotti* (fig. 50); structure of palp similar to that of female; figure 54 shows the modification of the setae at the tip of II-Leg-5; dorsal lengths of the distal segments of the third leg: III-Leg-4,  $137\mu$  ( $133\mu$ - $141\mu$ ); III-Leg-5,  $159\mu$  ( $159\mu$ - $177\mu$ ); III-Leg-6,  $176\mu$  ( $170\mu$ - $185\mu$ ); III-Leg-4 with four to seven short peg-like setae on the ventral side, III-Leg-5 with six to eleven short peg-like setae on ventral side; all legs with a few swimming hairs.

Female: Dorsal shield  $760\mu$  ( $653\mu$ - $760\mu$ ) in length,  $653\mu$  ( $577\mu$ - $669\mu$ ) in width; figure 69 shows the structure and "typical" color pattern of the dorsum; ventral shield  $798\mu$  ( $729\mu$ - $798\mu$ ) in length,  $744\mu$  ( $669\mu$ - $752\mu$ ) in width; capitular bay as described for the male; fourth coxae well separated medially; acetabular plate region  $349\mu$  ( $335\mu$ - $365\mu$ ) in width; acetabular plates extending laterally approximately in a line with the insertions of the fourth legs; genital acetabula 20-25 on each side, these surrounding a pair of glandularia; gonopore  $126\mu$  ( $116\mu$ - $126\mu$ ) in width; figure 66 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $27\mu$  ( $23\mu$ - $27\mu$ ); P-II,  $64\mu$  ( $62\mu$ - $64\mu$ ); P-III,  $39\mu$  ( $36\mu$ - $39\mu$ ); P-IV,  $62\mu$  ( $59\mu$ - $65\mu$ ); P-V,  $39\mu$  ( $35\mu$ - $39\mu$ ); a peg-like seta present distoventrally on medial surface of P-IV; figure 72 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $111\mu$  ( $104\mu$ - $118\mu$ ); I-Leg-5,  $152\mu$  ( $137\mu$ - $152\mu$ ); I-Leg-6,  $177\mu$  ( $165\mu$ - $181\mu$ ); all legs with swimming hairs, but fewer anteriorly.

Holotype: Adult  $\sigma$ , taken in an artificial pool beside Highway 29 one mile north of Immokalee, Collier County, Florida, November 16, 1970.

Allotype: Adult  $\text{♀}$ , from the Tamiami Canal (near the Collier County line), Dade County, Florida, November 14, 1970.

Paratypes: Four  $\sigma\sigma$ , same data as holotype; 2  $\sigma\sigma$ , 1  $\text{♀}$ , found in a pond beside Highway 48, nine miles northwest of Bushnell, Citrus County, Florida, November 11, 1970; 1  $\text{♀}$ , from Big Alligator Lake, Columbia County, Florida, April 9, 1950.

Discussion: I have a single male specimen from the next to last paratype collection locality which may or may not belong to the present species. It has a proportionally narrower body (fig. 70) and the peg-like setae on the third leg are more numerous (fig. 74). This specimen has six or seven peg-like setae on the fourth segment, ten or eleven on the fifth segment. "Typical" members of this species have four to six on the fourth segment, six to eight on the fifth segment. More material must be collected before it can be determined if this single individual actually belongs in *elaphra*.

The present species belongs to a species group which also includes *wolcotti* and the following species, *K. icota*. They are characterized by a capitular bay which is somewhat Y-shaped (narrow posteriorly, then abruptly widening in anterior one-half -- figs. 45, 71, 75). Males of the *wolcotti*-group have the setae at the tip of II-Leg-5 as shown in figure 54. Note that the heavy seta is placed well back from the distal end. The present species is most closely related to *K. wolcotti*, but tends to have a proportionally wider body, acetabular plates which do not extend well beyond the insertions of the fourth legs, and there are fewer acetabula (typically 38-48 on each side in *wolcotti*, 20-29 in *elaphra*).

## 12. Koenikea (Tanaognathella) icota, new species

(Figures 73, 75-78, 80)

Male: Dorsal shield  $555\mu$  in length,  $602\mu$  in width; dorsal shield distinctly angled, wider than long, and bearing six pairs of glandularia; color pattern and morphology of the dorsum indicated in figure 73; ventral shield  $620\mu$  in length,  $653\mu$  in width; capitular bay narrow posteriorly and then abruptly widening anteriorly; acetabular plates extending laterally, but not as far as insertions of the fourth legs; acetabular plate region  $236\mu$  in width; gonopore  $67\mu$  in length; genital acetabula 19-21 on each side, these completely surrounding a



pair of glandularia; figure 75 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $21\mu$ ; P-II,  $52\mu$ ; P-III,  $34\mu$ ; P-IV,  $48\mu$ ; P-V,  $25\mu$ ; structure of the palp as shown for the female; rostrum long, similar to that illustrated for *K. evida* (fig. 63); setae at tip of II-Leg-5 very similar to those shown in figure 54; dorsal lengths of the distal segments of the third leg: III-Leg-4,  $133\mu$ ; III-Leg-5,  $161\mu$ ; III-Leg-6,  $163\mu$ ; III-Leg-4 bearing five short peg-like setae on ventral side, III-Leg-5 with nine peg-like setae; segments of third leg proportionally very narrow (fig. 80); all legs with a few swimming hairs.

Female: Dorsal shield  $668\mu$  ( $608\mu$ - $668\mu$ ) in length,  $646\mu$  ( $585\mu$ - $646\mu$ ) in width; figure 78 shows the structure and color pattern of the dorsal shield; ventral shield  $741\mu$  ( $654\mu$ - $741\mu$ ) in length,  $740\mu$  ( $699\mu$ - $740\mu$ ) in width; capitular bay as described for the male; fourth coxae separated medially; acetabular plate region  $304\mu$  ( $272\mu$ - $304\mu$ ) in width; acetabular plates not extending laterally as far as insertions of the fourth legs; genital acetabula 21-26 on each side, these surrounding a pair of glandularia; gonopore  $118\mu$  ( $111\mu$ - $118\mu$ ) in width; figure 77 illustrates the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I,  $21\mu$  ( $21\mu$ - $23\mu$ ); P-II,  $60\mu$  ( $58\mu$ - $60\mu$ ); P-III,  $45\mu$  ( $42\mu$ - $45\mu$ ); P-IV,  $55\mu$  ( $51\mu$ - $55\mu$ ); P-V,  $31\mu$  ( $29\mu$ - $31\mu$ ); figure 76 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $104\mu$  ( $102\mu$ - $104\mu$ ); I-Leg-5,  $130\mu$  ( $126\mu$ - $130\mu$ ); I-Leg-6,  $148\mu$  ( $137\mu$ - $148\mu$ ); all legs with a few swimming hairs.

Holotype: Adult ♂, collected in a large pond in Hillsborough County, Florida, April 11, 1950.

Allotype: Adult ♀, same data as holotype.

Paratype: One ♀, same data as holotype.

Discussion: The structure of the capitular bay and the setae at the tip of II-Leg-5 in the male relate the present species to *wolcotti* and *elaphra*. It differs most noticeably in its proportionally much wider body (the male is actually wider than long), different color pattern, and proportionally very narrow segments of the legs (compare figure 80 with figures 49 and 74).

### 13. *Koenikea* (*Tanaognathella*) *alata* Lundblad

(Figures 48, 51, 53, 67)

*Koenikea alata* Lundblad, 1943. K. Svenska Vetenskap. Handl., 20(5): 15.

Male: Based on Lundblad's type slide. The specimen was originally preserved in alcohol or formalin making it fragile. Many of the leg segments were lost, especially the distal ones. Also, the color pattern was destroyed. Dorsal shield  $608\mu$  in length,  $547\mu$  in width; six pairs of glandularia present, dorsal shield not tapering gradually from middle anteriorly as is typical of most *Tanaognathella* males; most medial of the middle glandularia group placed well anterior to the other two pairs (fig. 53); ventral shield  $638\mu$  in length,  $593\mu$  in width; capitular bay forming a relatively uniform V-shape (fig. 51); acetabular plates extending posterolaterally nearly in a line with the insertions of the fourth legs; acetabular plate region  $297\mu$  in width; gonopore  $52\mu$  in length; genital acetabula 41-50 on each side, these completely surrounding a pair of glandularia; figure 51 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $27\mu$ ; P-II,  $66\mu$ ; P-III,  $48\mu$ ; P-IV,  $61\mu$ ; P-V,  $31\mu$ ; P-III proportionally long; figure 48 illustrates the proportions and chaetotaxy of the palp; capitulum (without rostrum)  $126\mu$  in length, rostrum

148 $\mu$  in length; setae at tip of II-Leg-5 similar to that illustrated for the following species (fig. 56); III-Leg-4 approximately 140 $\mu$  in length and bearing only three peg-like setae on ventral side (but what appear to be setal bases of others are present); other segments of the third leg absent.

Female: Apparently unknown. Females tentatively assigned to *K. aphrasta* might belong to the present species, but this seems doubtful. The palps of both sexes, as far as is known, are relatively similar in proportions and chaetotaxy. None of the females collected in northern North America (Michigan, Illinois, Ontario) have a proportionally long P-III as exhibited by the type of *alata*.

Habitat and Distribution: Lundblad recorded only that the type was collected in Michigan by Robert Wolcott. No date, habitat or more restricted locality information was given. Wolcott collected widely in the Lower Peninsula of Michigan, so there is no way of narrowing the type locality further.

Discussion: The posterolaterally directed acetabular plates and characteristic thickened setae at the tip of II-Leg-5 of the male will separate *alata* from all other species of the subgenus except the following, *K. evida*. See remarks under the latter.

#### 14. Koenikea (Tanaognathella) evida, new species

(Figures 56, 60, 63-65, 68)

Male: Dorsal shield 586 $\mu$  (578 $\mu$ -592 $\mu$ ) in length, 486 $\mu$  (486 $\mu$ -501 $\mu$ ) in width; dorsal shield bearing six pairs of glandularia; a pair of well developed lateral apophyses present; color pattern consisting of a central spindle-shaped patch much as that illustrated for the female (fig. 64); ventral shield 627 $\mu$  (623 $\mu$ -638 $\mu$ ) in length, 547 $\mu$  (547 $\mu$ -566 $\mu$ ) in width; capitular bay somewhat narrowed posteriorly, but more or less gradually tapering towards the anterior end (fig. 60); acetabular plates extending more or less posteriorly and not extending laterally as far as insertions of the fourth legs; acetabular plate region 228 $\mu$  (228 $\mu$ -236 $\mu$ ) in width; gonopore 59 $\mu$  (54 $\mu$ -59 $\mu$ ) in length; genital acetabula 28-33 on each side, these completely surrounding a pair of glandularia; figure 60 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, 29 $\mu$  (27 $\mu$ -29 $\mu$ ); P-II, 71 $\mu$  (69 $\mu$ -72 $\mu$ ); P-III, 50 $\mu$  (50 $\mu$ -52 $\mu$ ); P-IV, 60 $\mu$  (60 $\mu$ -66 $\mu$ ); P-V, 35 $\mu$  (31 $\mu$ -36 $\mu$ ); capitulum (without rostrum) approximately 118 $\mu$  in length, rostrum 189 $\mu$  in length; figure 63 illustrates a lateral view of the palp and capitulum; distal end of II-Leg-5 with characteristic heavy setae as shown in figure 56; dorsal lengths of the distal segments of the third leg: III-Leg-4, 135 $\mu$  (126 $\mu$ -135 $\mu$ ); III-Leg-5, 150 $\mu$  (145 $\mu$ -152 $\mu$ ); III-Leg-6, 148 $\mu$  (148 $\mu$ -155 $\mu$ ); III-Leg-4 with four to seven peg-like setae on the ventral side, III-Leg-5 with six or seven peg-like setae; figure 68 illustrates these segments; third and fourth legs with a few long swimming hairs, one or two shorter swimming hairs present on segments four and five of the other legs.

Female: Dorsal shield 669 $\mu$  in length, 562 $\mu$  in width; figure 64 shows the morphology and color pattern of the dorsal shield; ventral shield 714 $\mu$  in length, 653 $\mu$  in width; capitular bay somewhat narrower posteriorly than in the male; fourth coxae separated medially; acetabular plate region 318 $\mu$  in width; acetabular plates extending laterally somewhat beyond the insertions of the fourth legs; approximately 22 genital acetabula present on each side, these surrounding a pair of glandularia; gonopore 118 $\mu$  in width; figure 65 illustrates the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I, 27 $\mu$ ; P-II, 69 $\mu$ ; P-III, 50 $\mu$ ; P-IV, 67 $\mu$ ; P-V, 36 $\mu$ ; structure of palp and

capitulum as shown for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $115\mu$ ; I-Leg-5,  $148\mu$ ; I-Leg-6,  $164\mu$ ; a few swimming hairs present on all legs.

Holotype: Adult ♂, collected in Lake Tsala Apopka east of Inverness, Citrus County, Florida, November 11, 1970.

Allotype(?): Adult ♀, from a roadside canal on Highway US 1 in the southern part of Dade County, Florida, April 14, 1950.

Paratypes: Three ♂♂, same data as holotype.

Discussion: Males of *K. evida* may be separated from all other members of the subgenus, except *alata*, by its posterolaterally directed acetabular plates and numerous, short thickened setae at tip of II-Leg-5 (fig. 56). The present species differs from the latter in being larger, having a proportionally narrower body and capitular bay (compare figures 51, 60). Another noticeable difference is the proportionally much longer rostrum in the present species (compare figures 63, 67). The described female seems to belong to the present species but, until male and female are taken together in the same collection, this identification should be regarded as tentative.

#### 15. *Koenikea* (*Tanaognathella*) *aphrasta*, new species

(Figures 52, 55, 57-59, 61, 62)

Male: Dorsal shield  $456\mu$  ( $456\mu$ - $479\mu$ ) in length,  $441\mu$  ( $441\mu$ - $456\mu$ ) in width; dorsal shield widest in posterior one-half and gradually tapering anteriorly; six pair of glandularia and a pair of well developed apophyses present; color pattern similar to that shown for the female (fig. 57); ventral shield  $502\mu$  ( $502\mu$ - $524\mu$ ) in length,  $486\mu$  ( $486\mu$ - $510\mu$ ) in width; capitular bay forming a relatively uniform V-shape (fig. 59); acetabular plates extending laterally or very slightly posterolaterally, and extending as far laterally as the insertions of the fourth legs; acetabular plate region  $222\mu$  ( $222\mu$ - $243\mu$ ) in width; gonopore  $44\mu$  ( $37\mu$ - $51\mu$ ) in length; genital acetabula 21-30 on each side, these completely surrounding a pair of glandularia; dorsal lengths of the palpal segments: P-I,  $20\mu$  ( $20\mu$ - $21\mu$ ); P-II,  $46\mu$  ( $46\mu$ - $50\mu$ ); P-III,  $28\mu$  ( $28\mu$ - $31\mu$ ); P-IV,  $45\mu$  ( $43\mu$ - $46\mu$ ); P-V,  $31\mu$  ( $29\mu$ - $31\mu$ ); figure 61 shows the proportions and chaetotaxy of the palp; capitulum (without rostrum)  $96\mu$  in length, rostrum  $126\mu$  in length; setae at tip of II-Leg-5 as shown in figure 55; dorsal lengths of the distal segments of the third leg: III-Leg-4,  $111\mu$  ( $111\mu$ - $118\mu$ ); III-Leg-5,  $145\mu$  ( $145\mu$ - $148\mu$ ); III-Leg-6,  $133\mu$  ( $133\mu$ - $148\mu$ ); III-Leg-4 with four to seven short peg-like setae on ventral side, III-Leg-5 with five or six peg-like setae; figure 62 shows these segments; all legs with some swimming hairs, but these fewer and shorter anteriorly.

Female: (Not known with absolute certainty). A single female specimen from Florida appears to belong to the present species but is proportionally smaller than is typical in *Tanaognathella* females. Usually, the female is approximately  $150\mu$  longer than the male, but the Florida female is only  $50\mu$  longer than the male. Other females from more northern localities are also assigned to this species and with the latter the size differences are more in line with what one would expect. Measurements of the Florida specimen are given first, and the size range of the northern females is included in parentheses. None of the females are assigned to the type series.

Dorsal shield  $517\mu$  ( $616\mu$ - $668\mu$ ) in length,  $464\mu$  ( $532\mu$ - $593\mu$ ) in width; figure 57 shows the morphology and color pattern of the dorsal shield; ventral shield  $593\mu$  ( $684\mu$ - $730\mu$ ) in length,  $532\mu$  ( $608\mu$ - $684\mu$ ) in width; capitular bay

as in male; fourth coxae separated medially; acetabular plate region  $244\mu$  ( $334\mu$ - $364\mu$ ) in width; acetabular plates extending slightly lateral to the insertions of the fourth legs; genital acetabula 19-20 (30-35) on each side, these completely surrounding a pair of glandularia; gonopore  $100\mu$  ( $104\mu$ - $111\mu$ ) in width; figure 58 shows the structure of the ventral shield of the Florida specimen, figure 52 illustrates the venter on one of the northern females; dorsal lengths of the palpal segments: P-I,  $21\mu$  ( $21\mu$ - $22\mu$ ); P-II,  $52\mu$  ( $52\mu$ - $54\mu$ ); P-III,  $33\mu$  ( $33\mu$ - $36\mu$ ); P-IV,  $48\mu$  ( $48\mu$ - $53\mu$ ); P-V,  $28\mu$  ( $32\mu$ - $34\mu$ ); palp similar to that of male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $89\mu$  ( $100\mu$ - $103\mu$ ); I-Leg-5,  $111\mu$  ( $125\mu$ - $140\mu$ ); I-Leg-6,  $133\mu$  ( $137\mu$ - $148\mu$ ); swimming hairs as described in the male.

Holotype: Adult  $\sigma$ , collected in a pond beside Highway 48, nine miles northwest of Bushnell, Citrus County, Florida, November 11, 1970.

Paratypes: One  $\sigma$ , from Lake Tsala Apopka, on Highway 44 east of Inverness, Citrus County, Florida, November 11, 1970; 1  $\sigma$ , from Lake Opinicon (Chaffey's Locks), Leeds County, Ontario, July 29, 1972 (collected by Ian Smith).

Female Specimens: One  $\text{♀}$ , collected in Lake Tsala Apopka, Citrus County, Florida, April 9, 1950; 1  $\text{♀}$ , from Winter's Pond in Pine Hills Scenic Drive, Union County, Illinois, October 13, 1970; 2  $\text{♀♀}$ , same area as the Ontario paratype  $\sigma$ , on May 26, 1968 and August 23, 1970 (collected by Ian Smith); 1  $\text{♀}$ , from Lake Katchiwano near Lakefield, Peterborough County, Ontario, July 12, 1966 (collected by Ian Smith); 1  $\text{♀}$ , collected in Hann's Pond, Washtenaw County, Michigan (T1S/R5E/S6), May 23, 1952.

Discussion: The male specimens from Ontario and Florida are nearly identical except for a somewhat more extensive pigmentation in the individuals from the latter locality. The differences between the northern and southern females are greater than one would expect within a single species. It is reasonably certain that the northern females are conspecific with the northern male. What is not certain is if the Florida males and female are of the same species. It should be noted that the southern female came from the same locality as the paratype male from Florida, but that 20 years separated the two collections. More material needs to be collected and examined before any definite conclusion can be drawn but, if the Florida specimens are conspecific and the size differences between the females hold up, it would suggest the northern and southern populations belong to very closely related but separate species.

#### 16. Koenikea (Tanaognathella) connata, new species

(Figures 79, 81, 82)

Female: Dorsal shield  $608\mu$  ( $608\mu$ - $623\mu$ ) in length,  $494\mu$  ( $486\mu$ - $494\mu$ ) in width; dorsal shield bearing six pairs of glandularia and a pair of well developed lateral apophyses; dorsal shield narrowed anteriorly; figure 81 illustrates the typical color pattern of the dorsal shield; ventral shield  $695\mu$  ( $684\mu$ - $695\mu$ ) in length,  $570\mu$  ( $570\mu$ - $578\mu$ ) in width; capitular bay very narrow posteriorly and abruptly widening in anterior portion; fourth coxae touching medially; acetabular plate region  $310\mu$  ( $304\mu$ - $310\mu$ ) in width; acetabular plates extending laterally as far as insertions of the fourth legs; posterior end of acetabular plate region abruptly angled where it meets the ventral shield; genital acetabula 24-25 on each side, these completely surrounding a pair of glandularia; gonopore  $100\mu$  ( $100\mu$ - $103\mu$ ) in width; figure 82 shows the structure of the ventral shield;

dorsal lengths of the palpal segments: P-I,  $22\mu$  ( $22\mu$ - $24\mu$ ); P-II,  $48\mu$  ( $48\mu$ - $50\mu$ ); P-III,  $30\mu$  ( $30\mu$ - $31\mu$ ); P-IV,  $48\mu$  ( $46\mu$ - $48\mu$ ); P-V,  $30\mu$  ( $30\mu$ - $32\mu$ ); a well developed peg-like seta present at distoventral end of P-IV; P-V relatively sharp-pointed; figure 79 shows the proportions and chaetotaxy of the palp; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $96\mu$  ( $96\mu$ - $102\mu$ ); I-Leg-5,  $122\mu$  ( $118\mu$ - $122\mu$ ); I-Leg-6,  $133\mu$  ( $133\mu$ - $140\mu$ ); all legs with a few swimming hairs, but only those on the third and fourth legs longer than the following segment.

Male: Unknown.

Holotype: Adult ♀, found in the Tamiami Canal (near the Collier County line), Dade County, Florida, November 14, 1970.

Paratype: One ♀, from Lake Tsala Apopka near Inverness, Citrus County, Florida, November 11, 1970.

Discussion: The present species and the following, *K. smithi*, are members of a group which unfortunately are known only from the female. They are characterized by a short stocky palp, a very narrow capitular bay, fourth coxae which touch medially and a well developed pair of apophyses on the dorsal shield. See discussion section under the following species.

17. *Koenikea (Tanaognathella) smithi*, new species

(Figures 83-85)

Female: Dorsal shield  $668\mu$  in length,  $547\mu$  in width; dorsal shield with six pairs of glandularia and a pair of well developed apophyses laterally; dorsal shield oval and somewhat narrowed anteriorly; figure 84 shows the color pattern; ventral shield  $729\mu$  in length,  $638\mu$  in width; capitular bay very narrow posteriorly and then abruptly widening anteriorly; fourth coxae touching medially; acetabular plate region  $364\mu$  in width; acetabular plates extending laterally beyond the insertions of the fourth legs; posterior end of genital field region not abruptly angled where it meets the ventral shield; genital acetabula 34-35 on each side, these completely surrounding a pair of glandularia; gonopore  $110\mu$  in width; figure 83 shows the structure of the ventral shield; dorsal lengths of the palpal segments: P-I,  $24\mu$ ; P-II,  $48\mu$ ; P-III,  $26\mu$ ; P-IV,  $44\mu$ ; P-V,  $31\mu$ ; palpal segments stocky, a well developed peg-like seta at distoventral end of P-IV; tip of P-V blunt (fig. 85); dorsal lengths of the distal segments of the first leg: I-Leg-4,  $96\mu$ ; I-Leg-5,  $118\mu$ ; I-Leg-6,  $166\mu$ ; all legs with a few swimming hairs but only those of the third and fourth legs longer than the following segment.

Male: Unknown.

Holotype: Adult ♀, from Lake Opinicon (Chaffey's Locks), Leeds County, Ontario, October 18-20, 1972. This species collected by and named for Ian Smith. The holotype will be deposited in the Royal Ontario Museum.

Discussion: The present species is most closely related to *K. connata* (see discussion under the latter). *K. smithi* differs most noticeably from the latter in not having an abrupt angle where the genital field meets the ventral shield (compare figures 82, 83). Also, the palp of the present species has a much blunter P-V. Although males of these two species are unknown, it is probable they will have the very narrow capitular bay and stocky palp (with the relatively long peg-like seta at the distal end of P-IV), and they should be easily recognized.

18. Koenikea (Tanaognathus) spinipes spinipes (Wolcott)

(Figures 86-90)

*Tanaognathus spinipes* Wolcott, 1900. Trans. Amer. Microsc. Soc., 21: 194.*Tanaognathus spinipes* Wolcott, 1905. op. cit., 26: 196.*Koenikea spinipes* Marshall, 1935. Trans. Wisconsin Acad. Sci., 29: 276.*Koenikea spinipes* Lundblad, 1943. K. Svenska Vetenskap. Handl., 20(5): 3.

Male: Dorsal shield  $592\mu$ - $714\mu$  in length,  $577\mu$ - $710\mu$  in width; dorsal shield with six pairs of glandularia but apophyses are not apparent; color of dorsal shield typically a uniform dark with no distinct pattern (fig. 87); ventral shield  $631\mu$ - $749\mu$  in length,  $608\mu$ - $755\mu$  in width; acetabular plate region  $319\mu$ - $402\mu$  in width; gonopore  $35\mu$ - $53\mu$  in length; genital acetabula 32-69 on each side, these completely surrounding a pair of glandularia; figure 86 shows the angular body and great number of acetabula in one of the larger specimens from Michigan (however, some of the specimens from Michigan, and other northern areas, possess much fewer acetabula and a less angular body); dorsal lengths of the palpal segments: P-I,  $18\mu$ - $21\mu$ ; fused P-II and P-III,  $93\mu$ - $110\mu$ ; P-IV,  $19\mu$ - $24\mu$ ; P-V,  $24\mu$ - $28\mu$ ; P-IV with a peg-like projection (seta?) at distal end of medial surface; palp and capitulum proportions shown in figure 89; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $133\mu$ - $141\mu$ ; I-Leg-5,  $196\mu$ - $214\mu$ ; I-Leg-6,  $146\mu$ - $155\mu$ ; one of the claws at the tip of the first leg elongated,  $74\mu$ - $96\mu$  in length; typically there is an abrupt expansion of I-Leg-6 at the distal end and shown in figure 90 (but some specimens from Michigan show a gradual expansion more as shown in figure 94); all legs with at least a few swimming hairs.

Female: Dorsal shield  $805\mu$ - $871\mu$  in length,  $760\mu$ - $636\mu$  in width; structure and color pattern of dorsal shield as described for the male; ventral shield  $866\mu$ - $911\mu$  in length,  $881\mu$ - $958\mu$  in width; acetabular plate region  $403\mu$ - $494\mu$  in width; gonopore  $133\mu$  in width; genital acetabula 47-68 on each side, these surrounding a pair of glandularia; dorsal lengths of the palpal segments: P-I,  $21\mu$ - $26\mu$ ; fused P-II and P-III,  $117\mu$ - $132\mu$ ; P-IV,  $24\mu$ - $29\mu$ ; P-V,  $29\mu$ - $34\mu$ ; structure of palp and capitulum as shown for the male; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $142\mu$ - $152\mu$ ; I-Leg-5,  $192\mu$ - $215\mu$ ; I-Leg-6,  $174\mu$ - $182\mu$ ; swimming hairs as in male.

Habitat and Distribution: This is a lake and permanent pond inhabiting species which has previously been reported from Michigan, Wisconsin and Illinois. I have seen numerous specimens from Ontario in the collections of the Royal Ontario Museum.

19. Koenikea (Tanaognathus) spinipes carella, new subspecies

(Figures 91-94)

Male: Dorsal shield  $584\mu$ - $592\mu$  in length,  $547\mu$ - $570\mu$  in width; dorsal shield with six pairs of glandularia but apophyses are not apparent; color pattern of dorsal shield as illustrated for the female (fig. 92); ventral shield  $638\mu$ - $654\mu$  in length,  $608\mu$ - $623\mu$  in width; acetabular plate region  $288\mu$ - $296\mu$  in width; gonopore  $44\mu$ - $52\mu$  in length; genital acetabula 30-34 on each side; these surrounding a pair of glandularia; body tends to be less angular than in the typical subspecies (fig. 93); dorsal lengths of the palpal segments: P-I,  $14\mu$ - $17\mu$ ; fused P-II and P-III,  $97\mu$ - $100\mu$ ; P-IV,  $24\mu$ ; P-V,  $26\mu$ - $28\mu$ ; structure of palp

and capitulum similar to that shown for the typical subspecies (fig. 89); dorsal lengths of the distal segments of the first leg: I-Leg-4,  $126\mu$ - $137\mu$ ; I-Leg-5,  $189\mu$ - $200\mu$ ; I-Leg-6,  $140\mu$ ; one of the claws at the tip of the first leg greatly elongated,  $92\mu$ - $103\mu$  in length; terminal segment of first leg gradually expanding distally (fig. 94); all legs with at least a few swimming hairs.

Female: Dorsal shield  $714\mu$ - $927\mu$  in length,  $714\mu$ - $813\mu$  in width; figure 92 shows the typical structure and color pattern of the dorsal shield (however, the two smallest female specimens lack the central dark patch); ventral shield  $821\mu$ - $918\mu$  in length,  $821\mu$ - $958\mu$  in width; acetabular plate region  $357\mu$ - $380\mu$  in width; gonopore  $125\mu$ - $133\mu$  in width; genital acetabula 28-43 on each side, these surrounding a pair of glandularia; dorsal lengths of the palpal segments: P-I,  $17\mu$ - $22\mu$ ; fused P-II and P-III,  $117\mu$ - $130\mu$ ; P-IV,  $21\mu$ - $31\mu$ ; P-V,  $31\mu$ - $34\mu$ ; structure of palp and capitulum as shown for the typical subspecies; dorsal lengths of the distal segments of the first leg: I-Leg-4,  $131\mu$ - $148\mu$ ; I-Leg-5,  $185\mu$ - $200\mu$ ; I-Leg-6,  $163\mu$ - $178\mu$ ; swimming hairs as in male.

Holotype: Adult  $\sigma$ , collected in Lake Tsala Apopka east of Inverness, Citrus County, Florida, November 11, 1970.

Allotype: Adult  $\text{♀}$ , same data as the holotype.

Paratypes: One  $\text{♀}$ , same data as holotype; 1  $\text{♀}$ , from a pond beside Highway 31 (five miles north of the Lee County line), Charlotte County, Florida, November 13, 1970; 1  $\sigma$ , 1  $\text{♀}$ , from the Tamiami Canal (near the Collier County line), Dade County, Florida, November 14, 1970; 2  $\text{♀♀}$  (tentatively assigned to the type series), from a pond on Highway US 90, two miles east of Ponce de Leon, Holmes County, Florida, November 8, 1970.

Discussion: Although there is overlapping in many of the characters in the northern and southern populations of *spinipes*, there seem to be sufficient differences to justify subspecies separation. The most noticeable differences are the narrower genital field regions and fewer acetabula in the specimens from Florida and also the difference in color patterns. The last two females in the paratype series are smaller and lack the central color patch shown in figure 92. They are placed in *carella* but, until the male is taken, this disposition should be regarded as tentative.

## 20. Koenikea (Tanaognathus) floridensis, new species

(Figures 95-97)

Male: Dorsal shield  $592\mu$  ( $577\mu$ - $592\mu$ ) in length,  $638\mu$  ( $635\mu$ - $638\mu$ ) in width; dorsal shield with irregular edges and bearing six pairs of glandularia; apophyses not apparent; figure 97 shows the color pattern of the dorsal shield; ventral shield  $653\mu$  ( $638\mu$ - $653\mu$ ) in length,  $669\mu$  ( $669\mu$ - $684\mu$ ) in width; body widest anterior to middle; acetabular plate region  $285\mu$  ( $285\mu$ - $289\mu$ ) in width; gonopore  $24\mu$  ( $24\mu$ - $28\mu$ ) in length; genital acetabula 23-30 on each side, these completely surrounding a pair of glandularia; figure 96 shows the morphology of the ventral shield; dorsal lengths of the palpal segments: P-I,  $15\mu$  ( $13\mu$ - $15\mu$ ); fused P-II and P-III,  $104\mu$  ( $104\mu$ - $106\mu$ ); P-IV,  $17\mu$  ( $17\mu$ - $19\mu$ ); P-V,  $23\mu$  ( $23\mu$ - $24\mu$ ); structure of palp and capitulum much as shown for the related species (fig. 89); dorsal lengths of the distal segments of the first leg: I-Leg-4,  $111\mu$  ( $111\mu$ - $125\mu$ ); I-Leg-5,  $174\mu$  ( $168\mu$ - $174\mu$ ); I-Leg-6,  $158\mu$  ( $133\mu$ - $158\mu$ ); one of the claws of the first leg elongated,  $62\mu$  in length; segments of the first leg relatively slender compared to *spinipes* (fig. 95); all legs with at least a few swimming hairs.

Female: Unknown.

Holotype: Adult ♂, collected in the Tamiami Canal (near the Collier County line), Dade County, Florida, November 14, 1970.

Paratype: One ♂, from a pond in Hillsborough County, Florida, April 8, 1950.

Discussion: The present species differs from *K. spinipes* in its more angular body (which is widest anterior to middle), dorsal shield which is much wider than long, and the proportionally much narrower leg segments, especially in the first leg (compare figures 90, 95).

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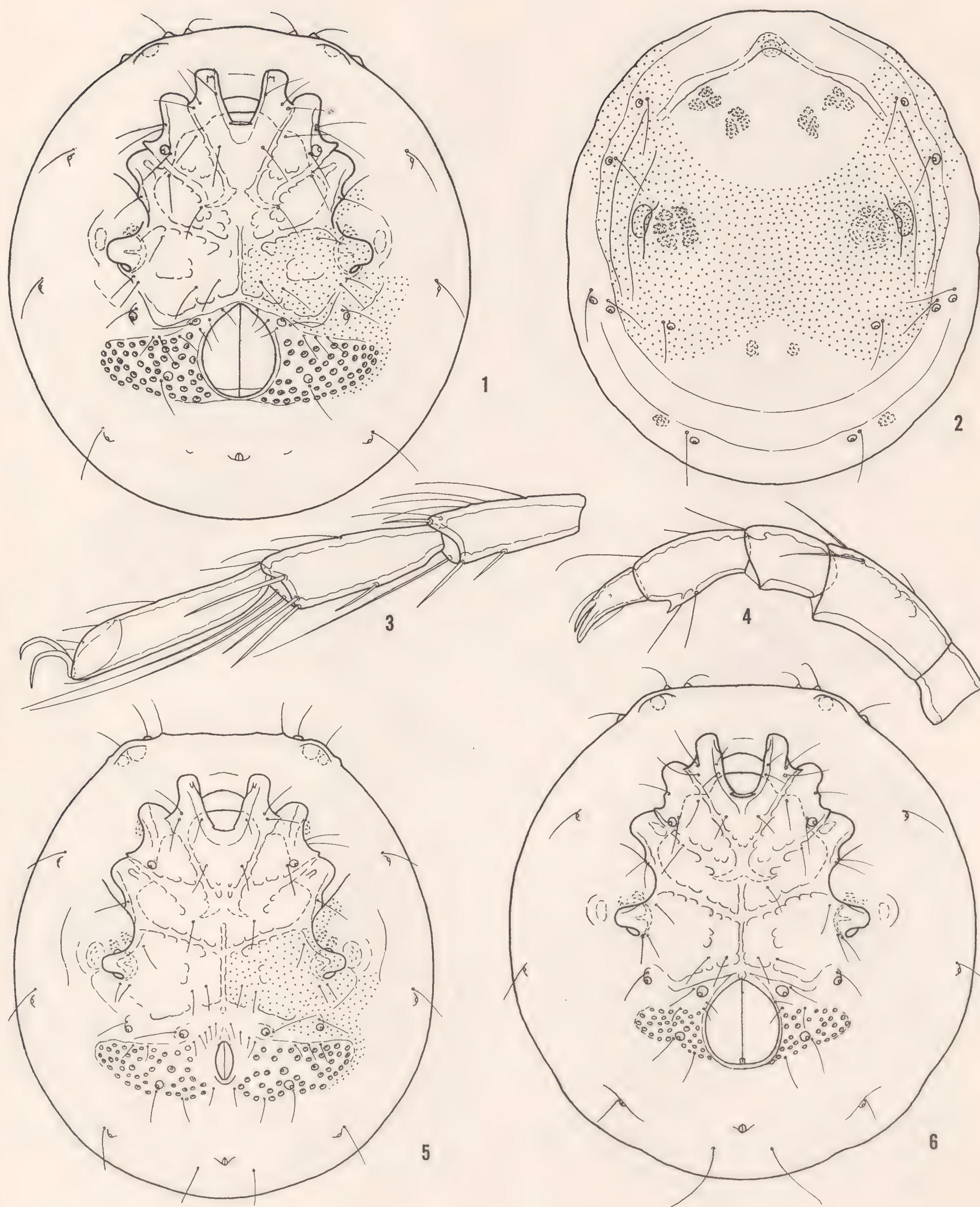
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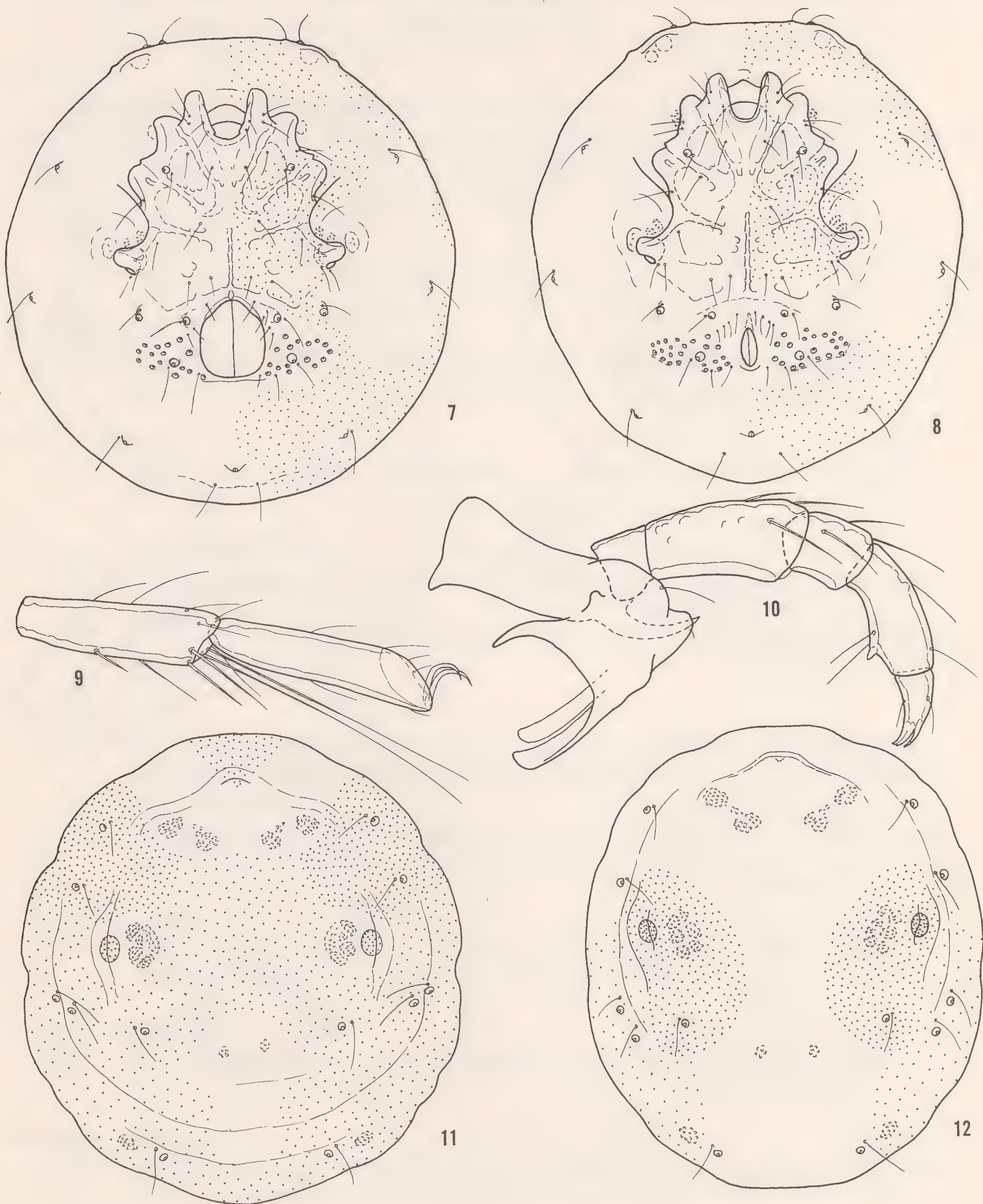
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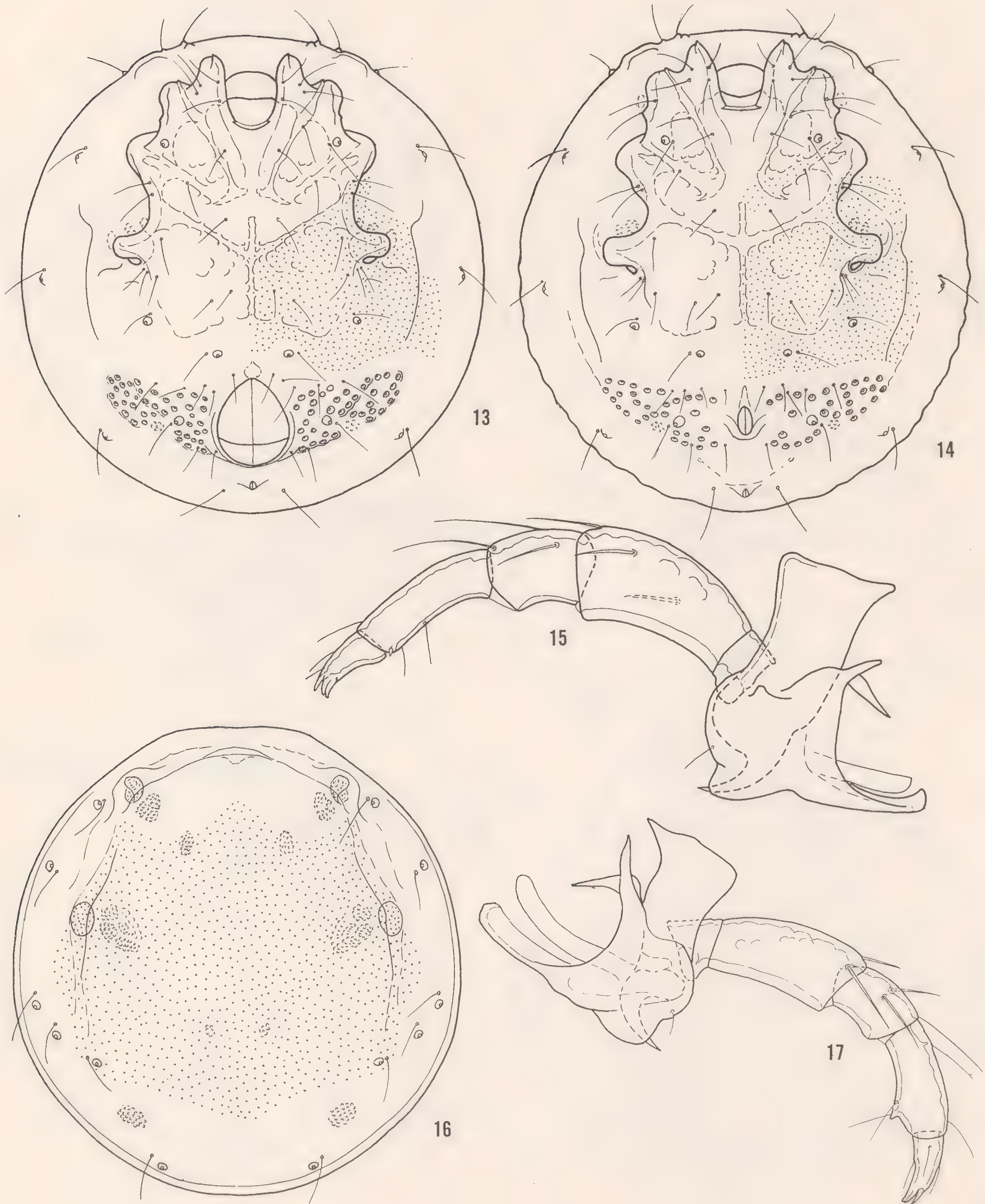


*Koenikea concava* Wolcott Fig. 1, ventral shield, female; Fig. 2, dorsal shield, female; Fig. 5, ventral shield, male.

*Koenikea arpeda* n. sp. Fig. 3, distal segments of first leg, female; Fig. 4, palp, female; Fig. 6, ventral shield, female.

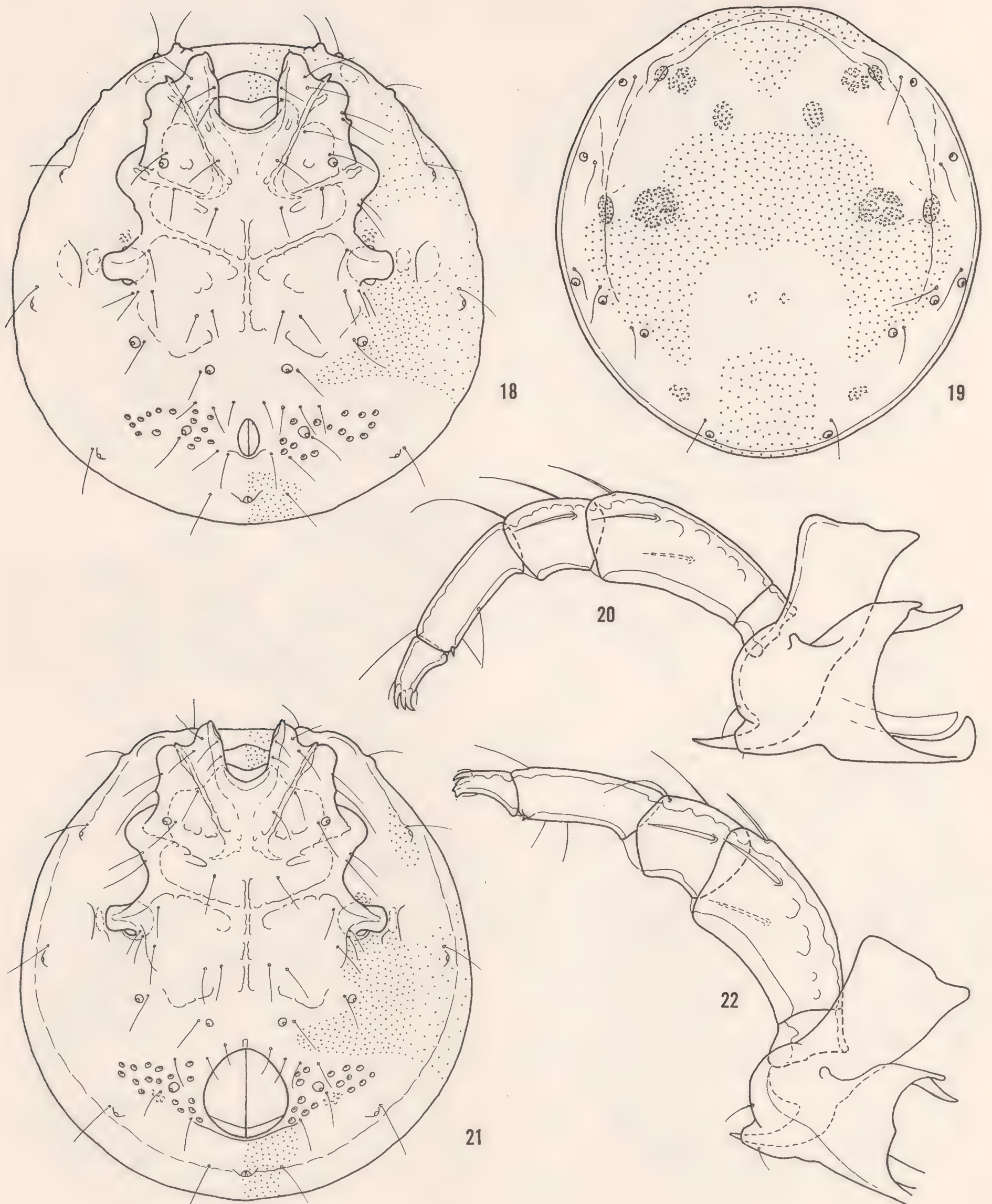


Koenikea angulata n. sp. Fig. 7, ventral shield, female; Fig. 8, ventral shield, male; Fig. 9, distal segments of first leg, male; Fig. 10, lateral view of palp and capitulum, male; Fig. 11, dorsal shield, female.  
Koenikea arpeda n. sp. Fig. 12, dorsal shield, female.



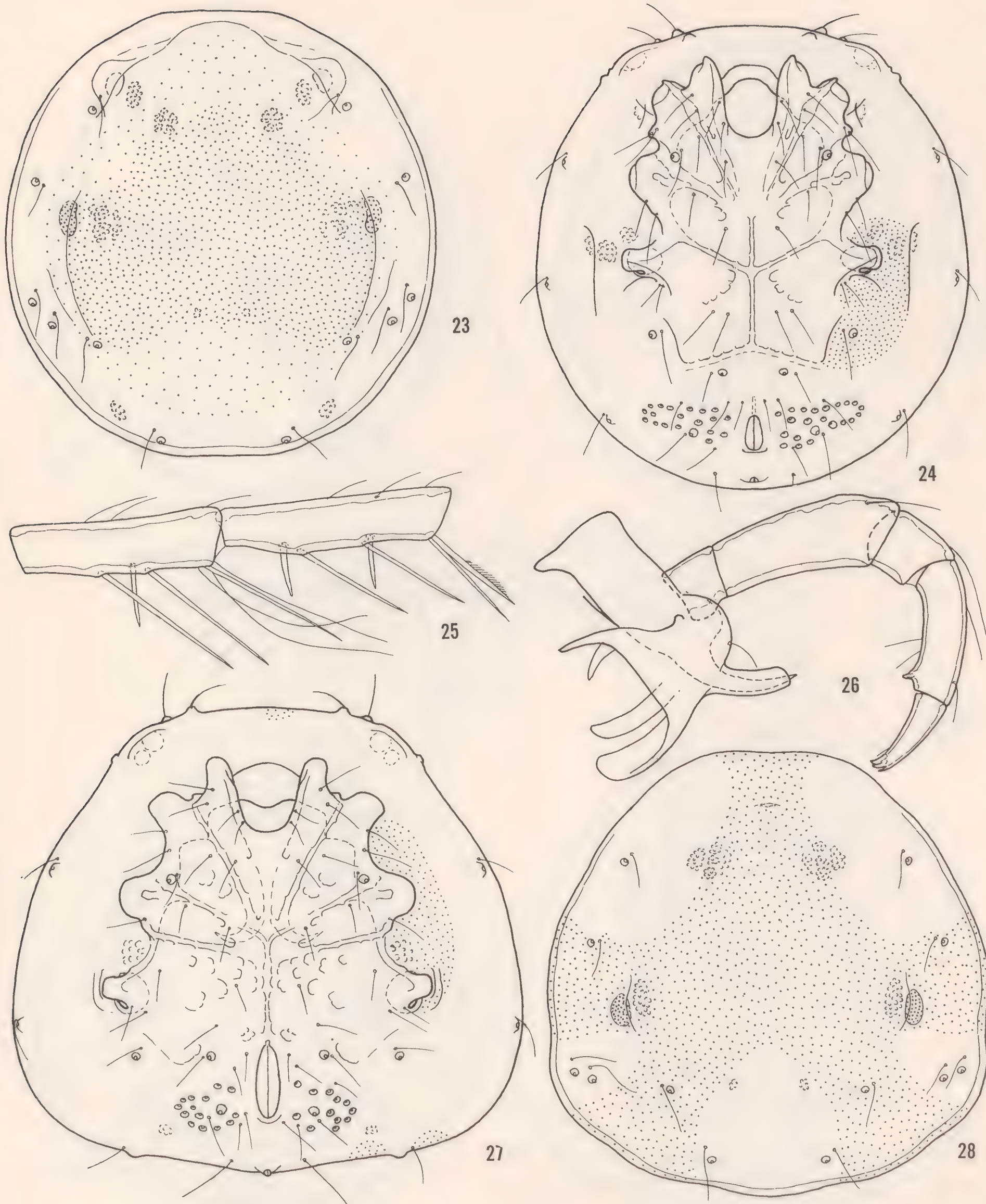
*Koenikea haldemani* Viets Fig. 13, ventral shield, female; Fig. 14, ventral shield, male; Fig. 15, lateral view of palp and capitulum, female; Fig. 16, dorsal shield, female.

*Koenikea concava* Wolcott Fig. 17, lateral view of palp and capitulum, female.



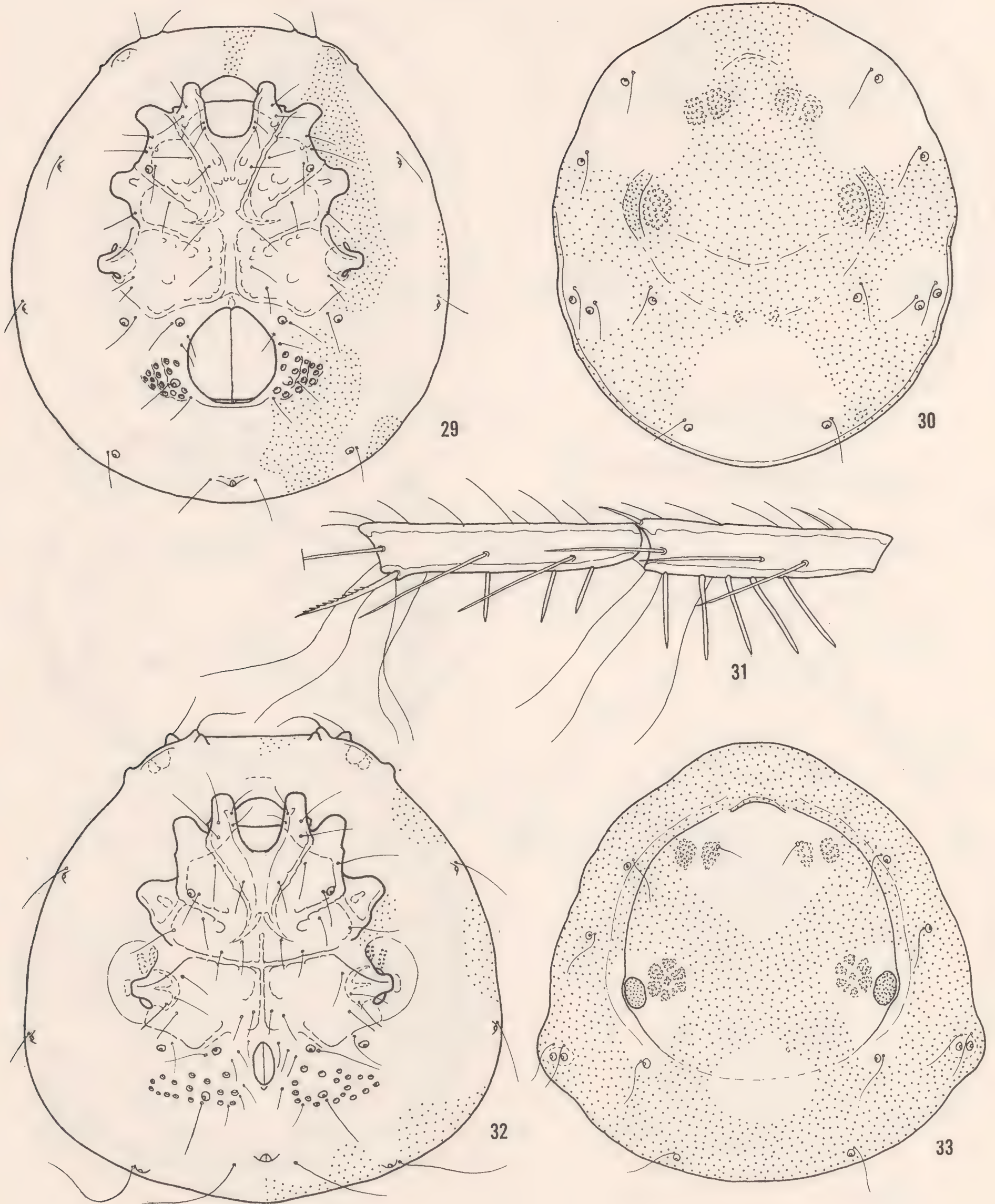
Koenikea platama n. sp. Fig. 18, ventral shield, male; Fig. 19, dorsal shield, female; Fig. 20, lateral view of palp and capitulum, male; Fig. 21, ventral shield, female.

Koenikea vidua n. sp. Fig. 22, lateral view of palp and capitulum, male.



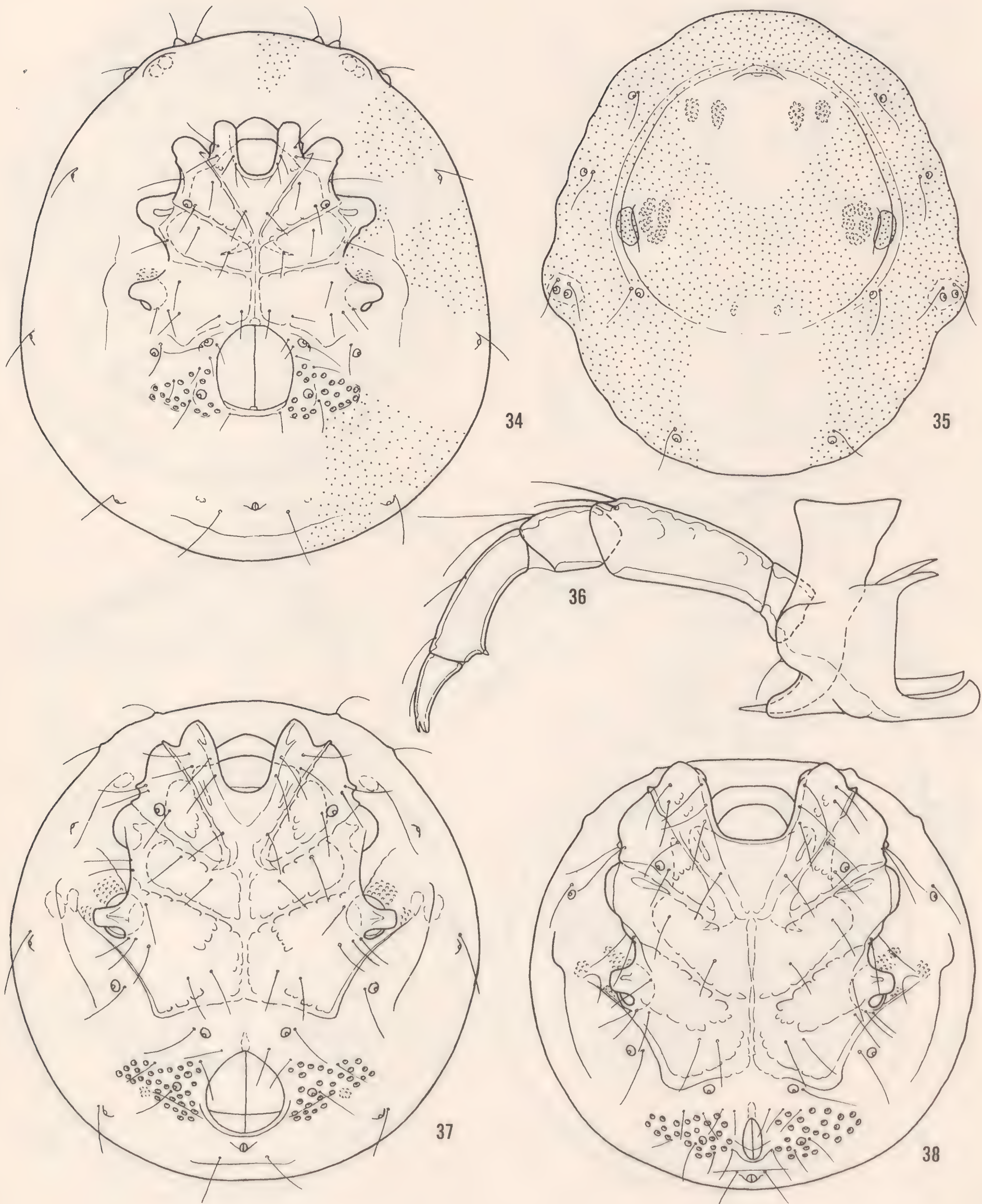
*Koenikea vidua* n. sp. Fig. 23, dorsal shield, male; Fig. 24, ventral shield, male.

*Koenikea stellata* n. sp. Fig. 25, III-Leg-4 and 5, male; Fig. 26, lateral view of palp and capitulum, male; Fig. 27, ventral shield, male; Fig. 28, dorsal shield, male.

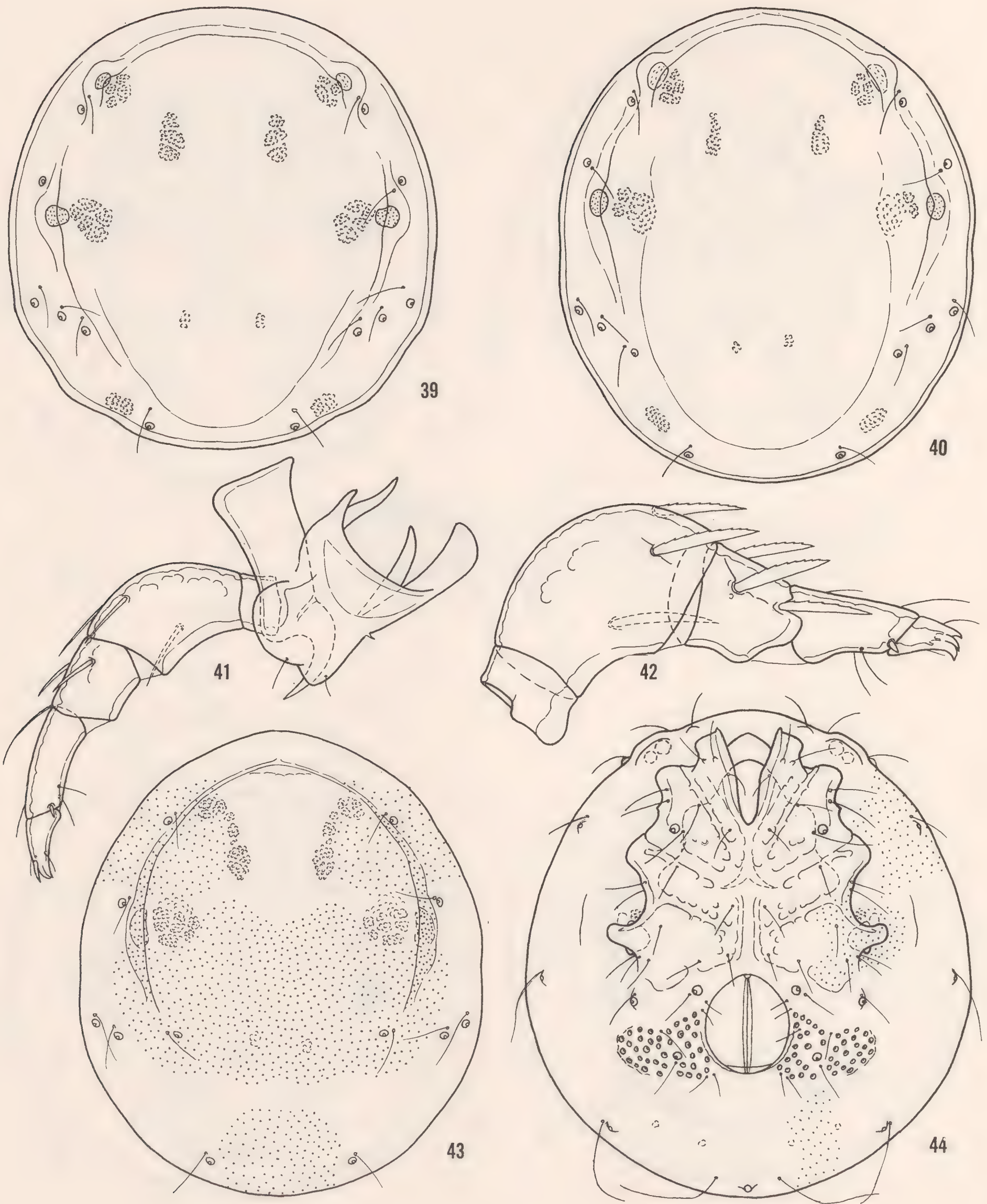


Koenikea stellata n. sp. Fig. 29, ventral shield, female; Fig. 30, dorsal shield, female.

Koenikea himerta n. sp. Fig. 31, III-Leg-4 and 5, male; Fig. 32, ventral shield, male; Fig. 33, dorsal shield, male.



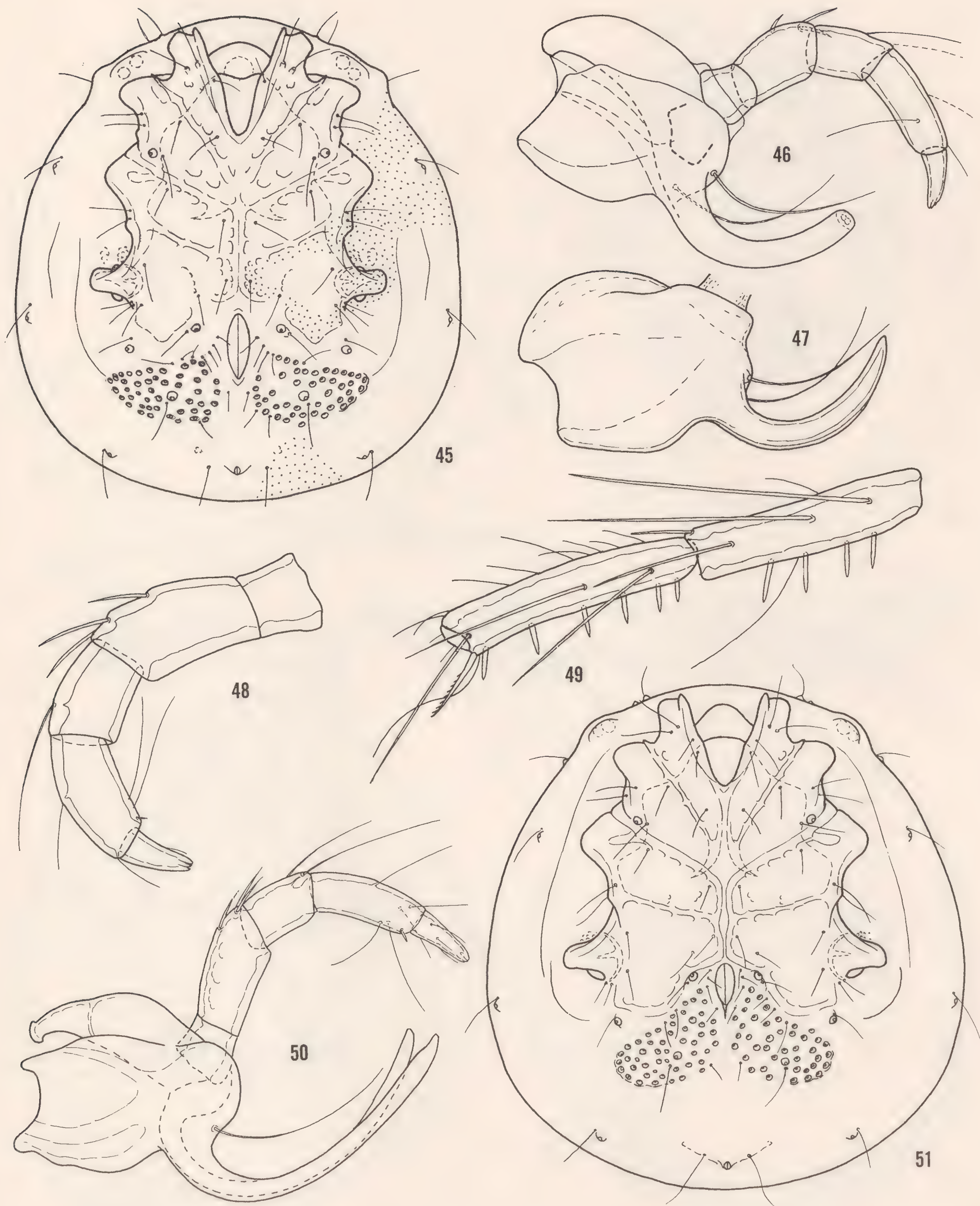
*Koenikea himerta* n. sp. Fig. 34, ventral shield, female; Fig. 35, dorsal shield, female; Fig. 36, lateral view of palp and capitulum, male.  
*Koenikea expansipalpis* Cook Fig. 37, ventral shield, female; Fig. 38, ventral shield, male.



Koenikea expansipalpis Cook Fig. 39, dorsal shield, male; Fig. 40, dorsal shield, female; Fig. 41, lateral view of palp and capitulum, female; Fig. 42, palp, male.

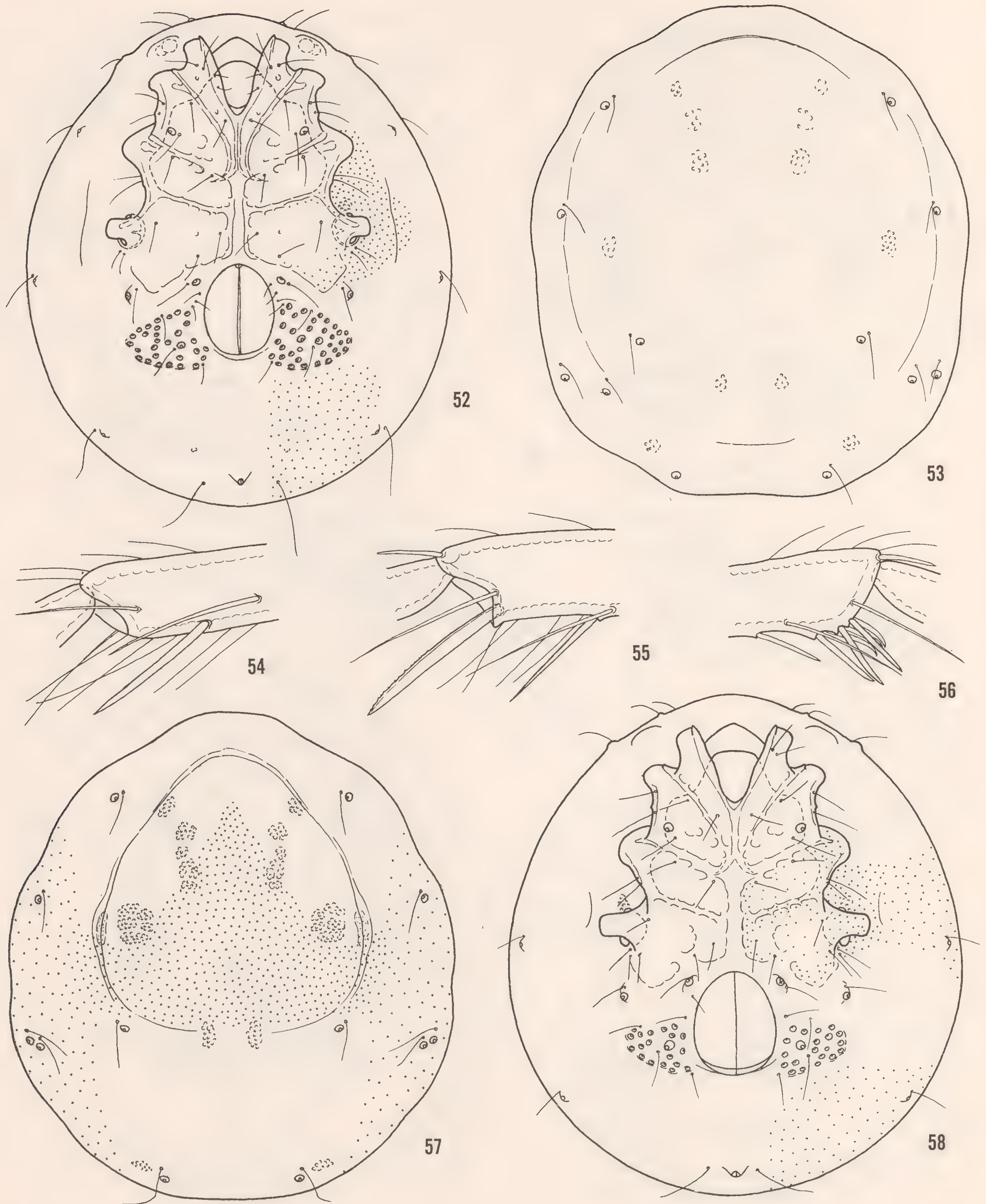
Koenikea wolcottii Viets Fig. 43, dorsal shield, female; Fig. 44, ventral shield, female.





*Koenikea wolcotti* Viets Fig. 45, ventral shield, male; Fig. 46, lateral view of palp and capitulum, female (from Wolcott's type slide); Fig. 47, lateral view of capitulum, female (after Wolcott, 1900); Fig. 49, III-Leg-4 and 5, male; Fig. 50, lateral view of palp and capitulum, female.

*Koenikea alata* Lundblad Fig. 48, palp, male; Fig. 51, ventral shield, male.

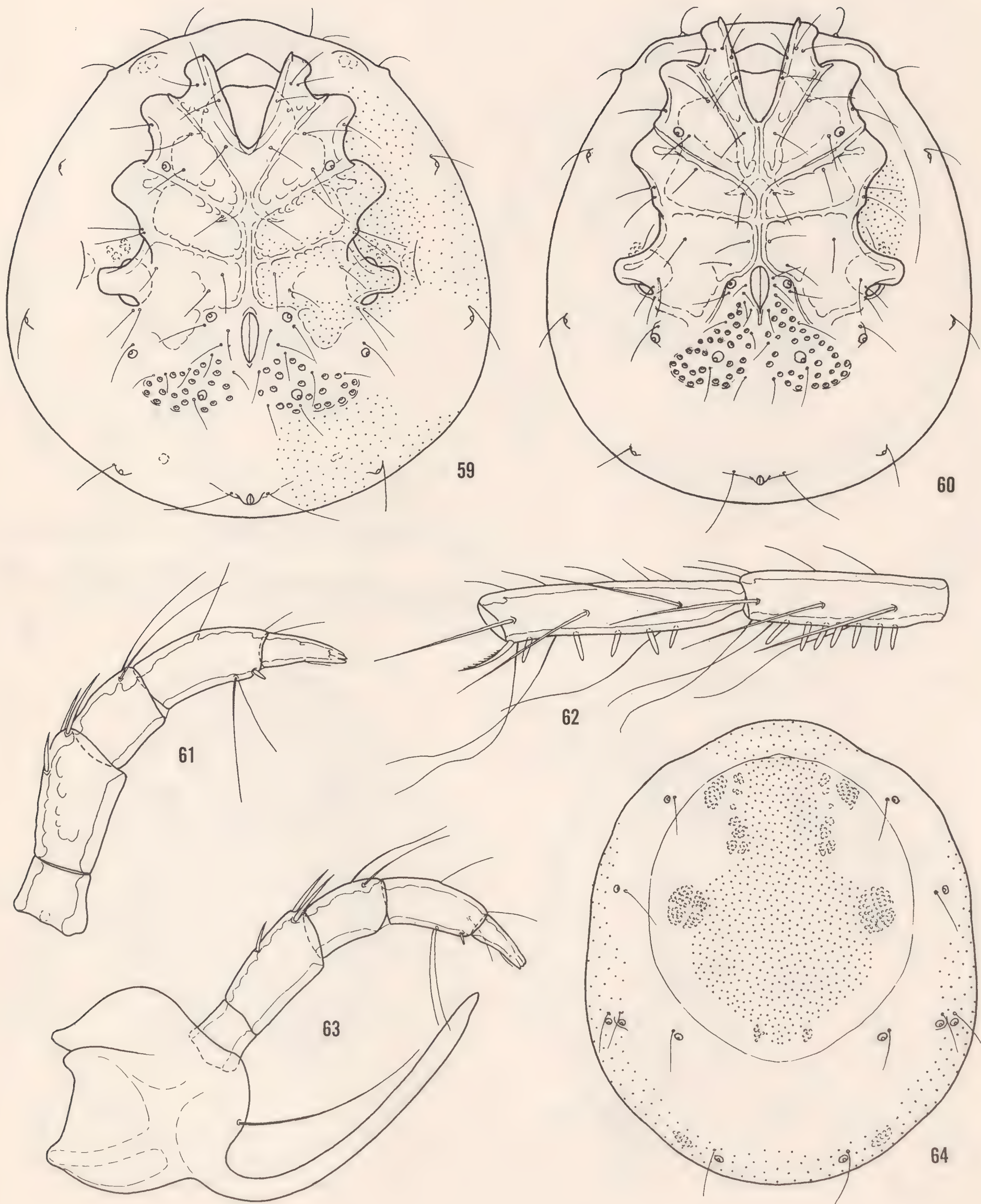


Koenikea ahrasta n. sp. Fig. 52, ventral shield, female; Fig. 55, distal end of II-Leg-5, male; Fig. 57, dorsal shield, female; Fig. 58, ventral shield, female.

Koenikea alata Lundblad Fig. 53, dorsal shield, male.

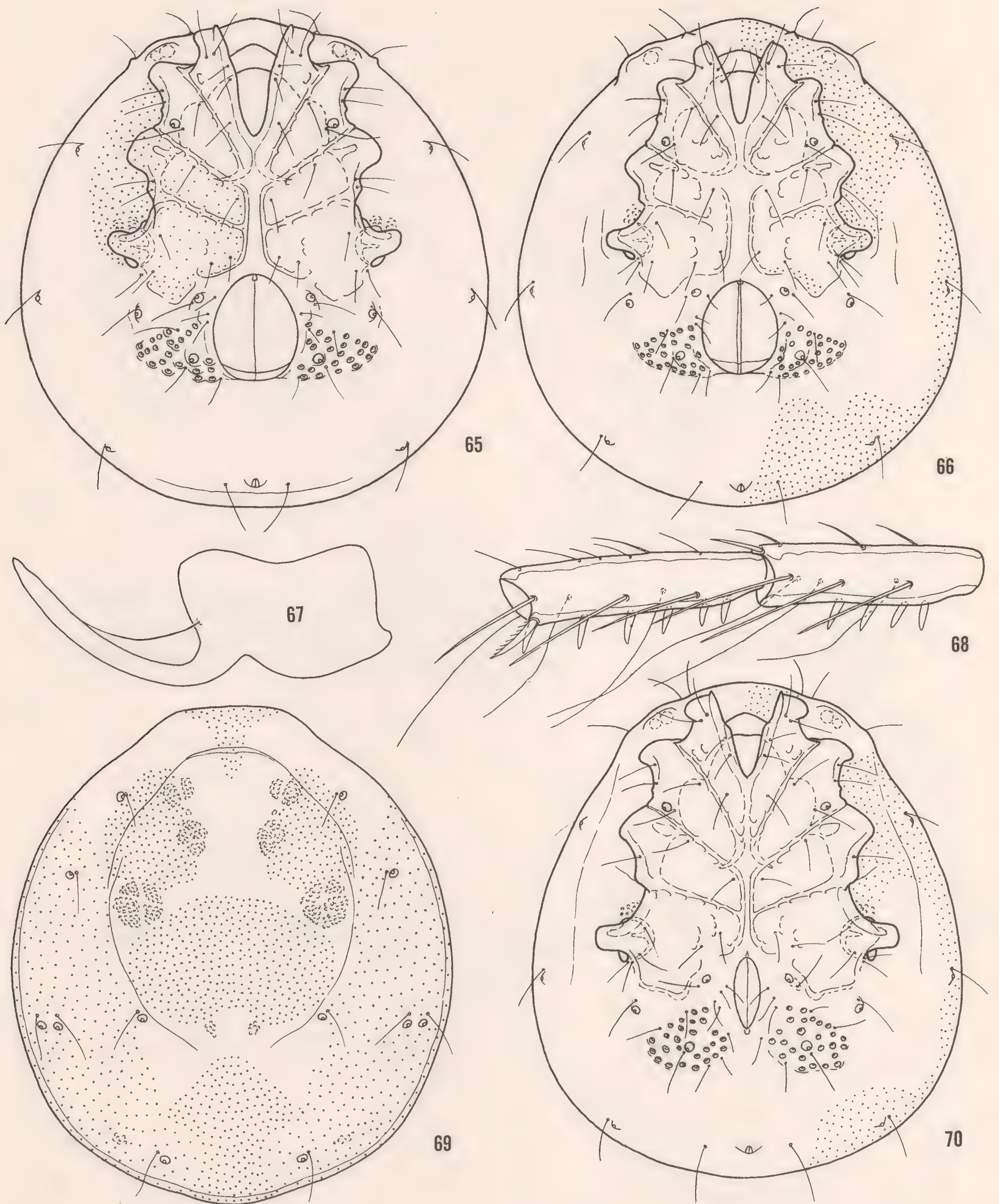
Koenikea elaphra n. sp. Fig. 54, distal end of II-Leg-5, male.

Koenikea evida n. sp. Fig. 56, distal end of II-Leg-5, male.



*Koenikea aphrasta* n. sp. Fig. 59, ventral shield, male; Fig. 61, palp, male;  
Fig. 62, III-Leg-4 and 5, male.

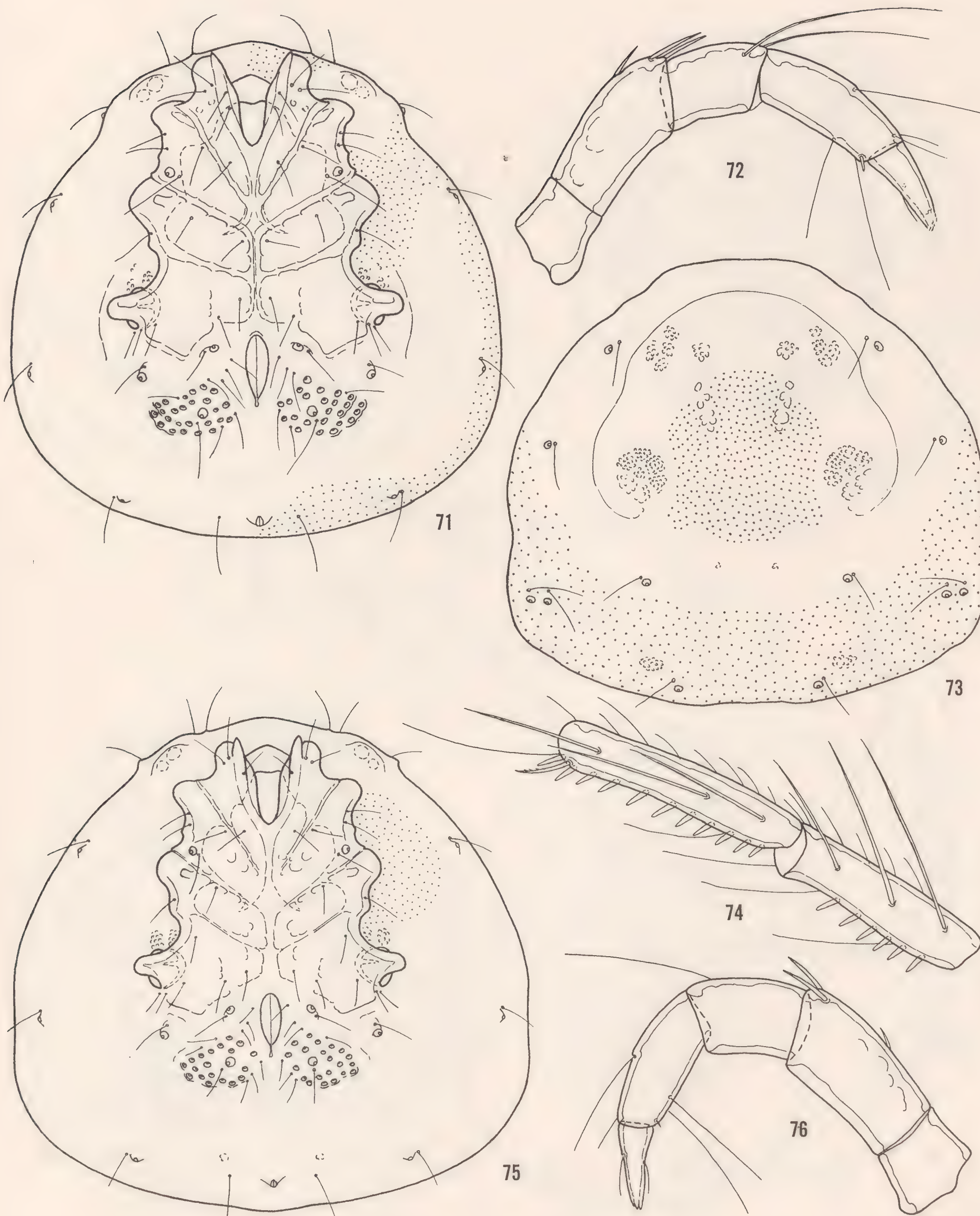
*Koenikea evida* n. sp. Fig. 60, ventral shield, male; Fig. 63, lateral view of  
palp and capitulum, male; Fig. 64, dorsal shield, female.



Koenikea evida n. sp. Fig. 65, ventral shield, female; Fig. 68, III-Leg-4 and 5, male.

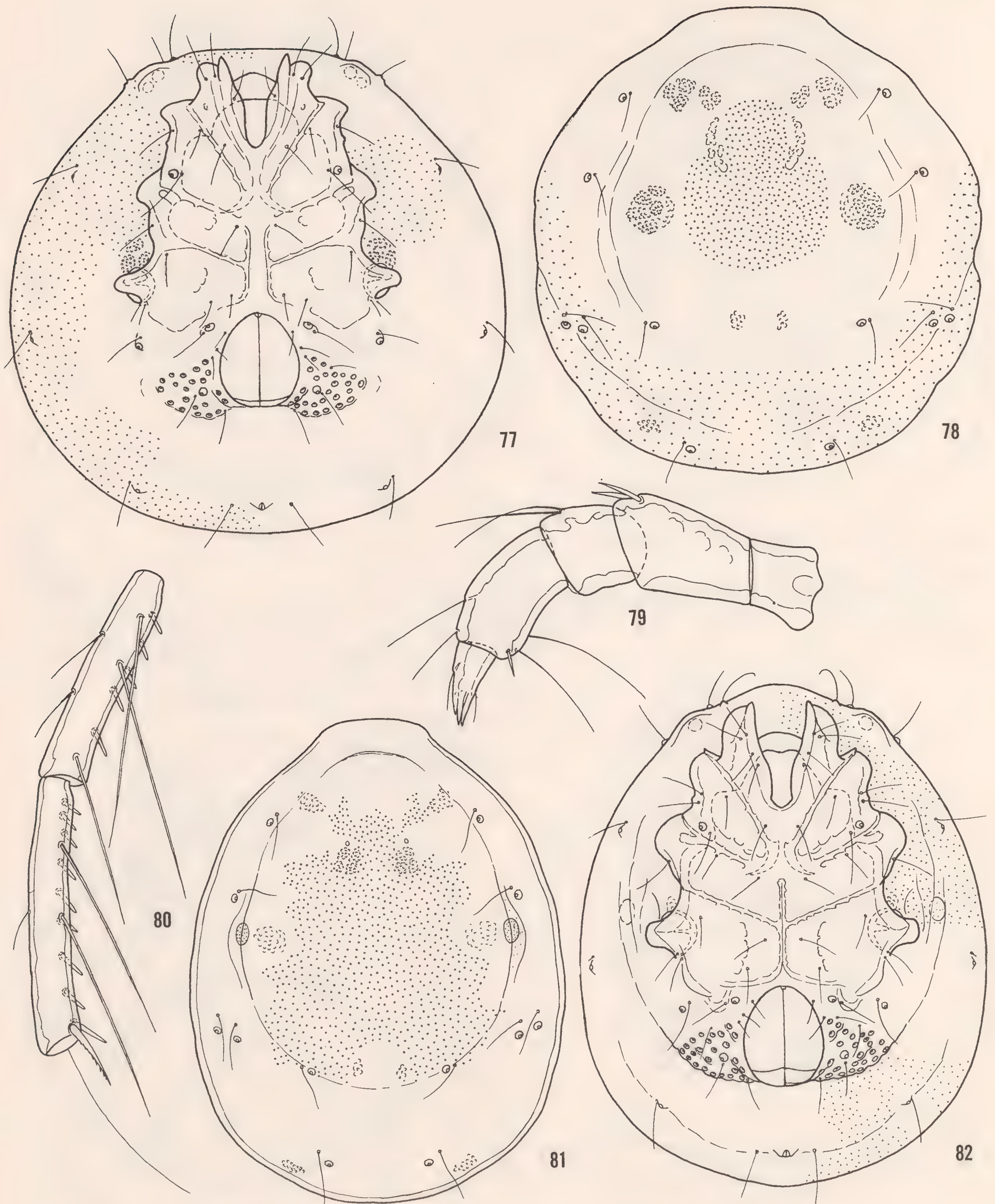
Koenikea elaphra n. sp. Fig. 66, ventral shield, female; Fig. 69, dorsal shield, female; Fig. 70, ventral shield, male.

Koenikea alata Lundblad Fig. 67, lateral view of capitulum, male.



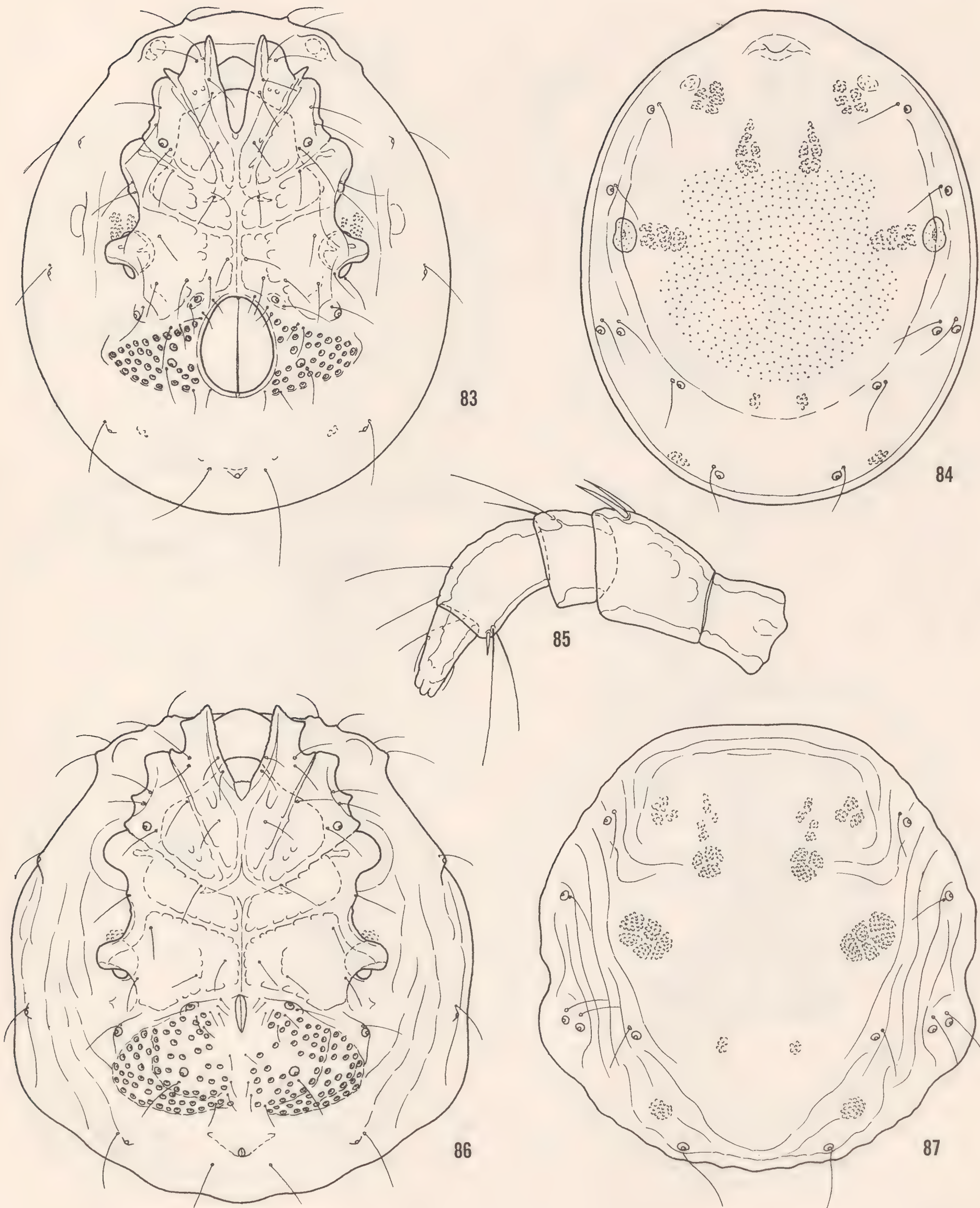
*Koenikea elaphra* n. sp. Fig. 71, ventral shield, male; Fig. 72, palp, female;  
Fig. 74, III-Leg-4 and 5, male.

*Koenikea icota* n. sp. Fig. 73, dorsal shield, male; Fig. 75, ventral shield,  
male; Fig. 76, palp, female.



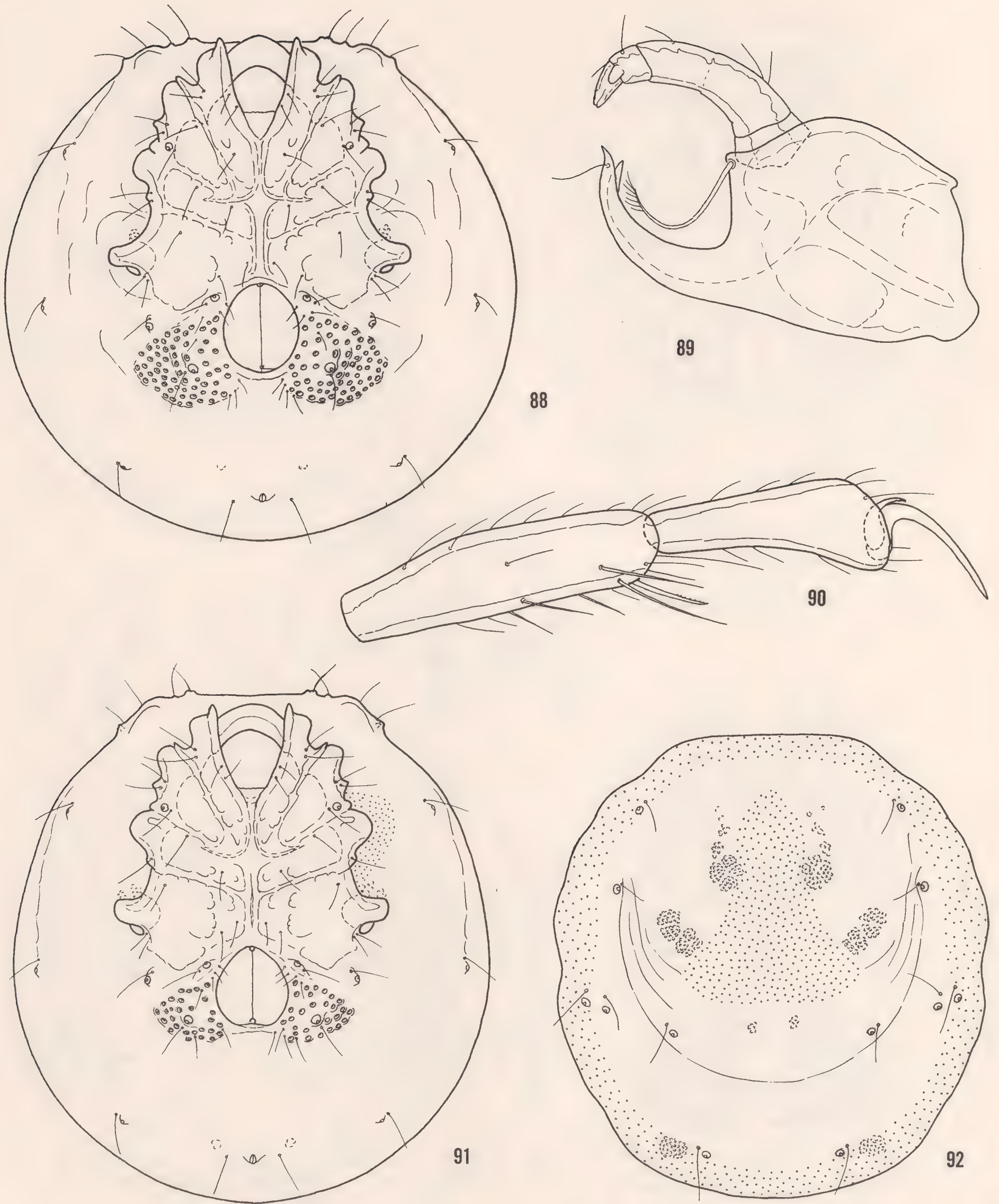
*Koenikea icota* n. sp. Fig. 77, ventral shield, female; Fig. 78, dorsal shield, female; Fig. 80, III-Leg-4 and 5, male.

*Koenikea connata* n. sp. Fig. 79, palp, female; Fig. 81, dorsal shield, female; Fig. 82, ventral shield, female.



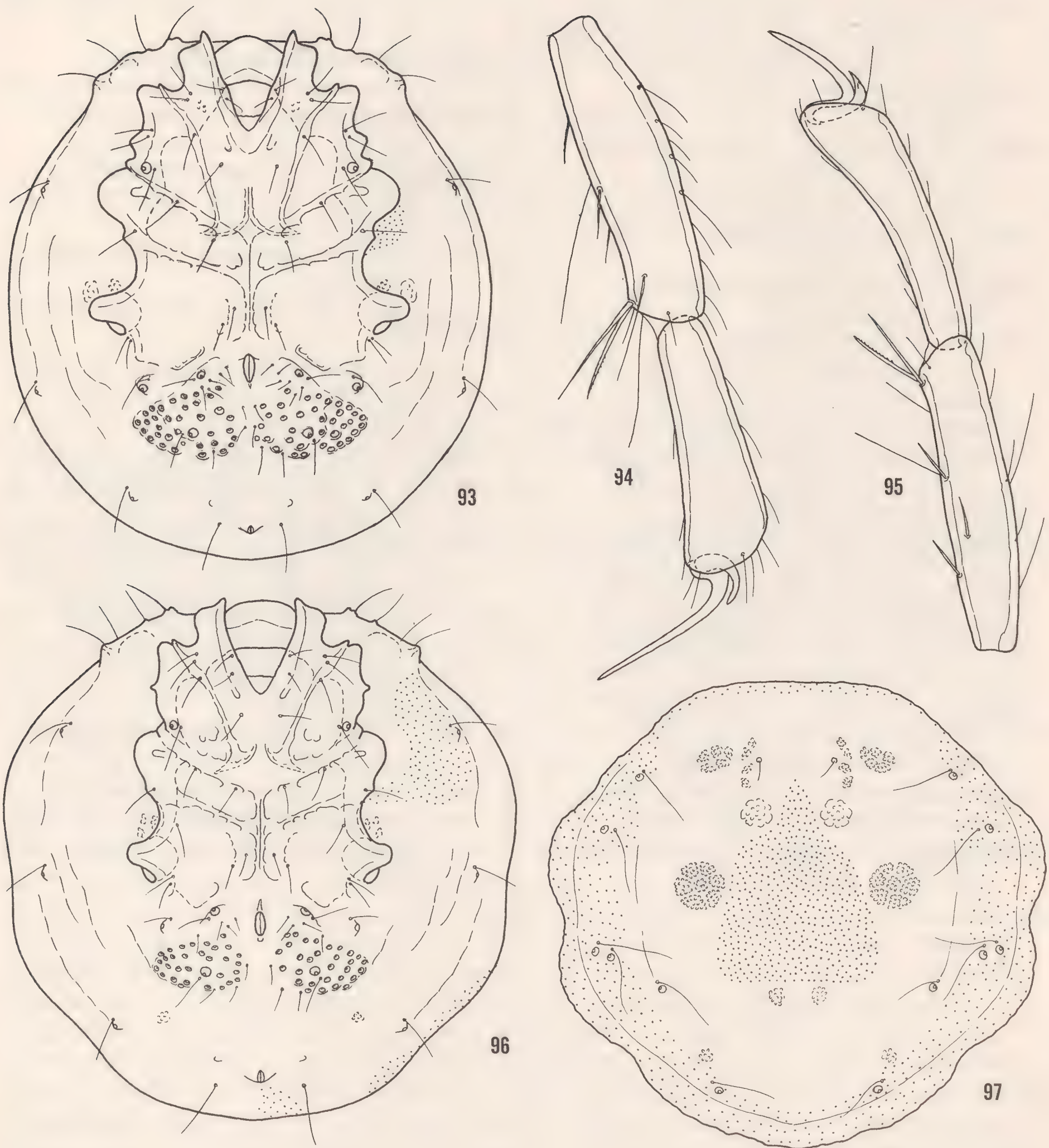
*Koenikea smithi* n. sp. Fig. 83, ventral shield, female; Fig. 84, dorsal shield, female; Fig. 85, palp, female.

*Koenikea spinipes spinipes* Wolcott Fig. 86, ventral shield, male; Fig. 87, dorsal shield, male.



Koenikea spinipes spinipes Wolcott Fig. 88, ventral shield, female; Fig. 89, lateral view of palp and capitulum, male; Fig. 90, I-Leg-5 and 6, male.  
Koenikea spinipes carella n. ssp. Fig. 91, ventral shield, female; Fig. 92, dorsal shield, female.





*Koenikea spinipes carella* n. ssp. Fig. 93, ventral shield, male; Fig. 94, I-Leg-5 and 6, male.

*Koenikea floridensis* n. sp. Fig. 95, I-Leg-5 and 6, male; Fig. 96, ventral shield, male; Fig. 97, dorsal shield, male.

\*An asterisk indicates a synonym.  
The main reference is underscored.

- alata (Koenikea, Tanaognathella) 59,  
60, 62 (key), 75, 77, figs. 48, 51,  
53, 67
- angulata (Koenikea) 61 (key), 64,  
figs. 7-11
- aphrasta (Koenikea, Tanaognathella)  
62 (key), 63 (key), 76, 77,  
figs. 52, 55, 57-59, 61, 62
- arpeda (Koenikea) 61 (key), 64, 65,  
figs. 3, 4, 6, 12
- assimilus (Koenikea clavigera,  
Diplokoenikea) 70
- carella (Koenikea spinipes,  
Tanaognathus) 63 (key), 80, 81,  
figs. 91-94
- clavigera (Koenikea, Diplokoenikea) 70
- concava (Koenikea) 59, 61 (key), 63,  
64, 72, 73, figs. 1, 2, 5, 17
- concava-group 61 (key), 65
- connata (Koenikea, Tanaognathella)  
62 (key), 78, 79, figs. 79, 81, 82
- Diplokoenikea 59, 60 (key), 69, 70
- elaphra (Koenikea, Tanaognathella)  
62 (key), 73, 74, 75, figs. 54,  
66, 69-72, 74
- evida (Koenikea, Tanaognathella)  
62 (key), 63 (key), 75, 76, 77,  
figs. 56, 60, 63-65, 68
- expansipalpis (Koenikea, Sespekoeni-  
kea) 61 (key), 66, 71, figs. 37-42
- floridensis (Koenikea, Tanaognathus)  
63 (key), 81, figs. 95-97
- haldemani (Koenikea) 59, 61 (key), 66,  
67, 68, figs. 13-16
- haldemani-group 61 (key), 71
- hamulata (Koenikea, Diplokoenikea) 59
- himerta (Koenikea, Diplokoenikea)  
60 (key), 69, 70, figs. 31-36
- icota (Koenikea, Tanaognathella)  
62 (key), 74, figs. 73, 75-78, 80
- Koenikea 59, 61 (key), 64
- \*marshallae (Koenikea, Tanaognath-  
ella) 59, 72, 73
- pectinifera (Koenikea, Diplokoenikea)  
70
- platama (Koenikea) 61 (key), 67, 68,  
figs. 18-21
- Pseudokoenikea 73
- Sespekoenikea 61 (key), 71
- smithi (Koenikea, Tanaognathella)  
62 (key), 79, figs. 83-85
- spinipes (Koenikea, Tanaognathus) 59,  
63 (key), 80, 81, 82, figs. 86-89
- stellata (Koenikea, Diplokoenikea)  
60 (key), 68, 69, figs. 25-30
- Tanaognathella 59, 61 (key), 73
- Tanaognathus 59, 63 (key)
- Unionicolidae 59
- vidua (Koenikea) 61 (key), 67, 68,  
figs. 22-24
- wolcotti (Koenikea, Tanaognathella,  
Pseudokoenikea) 59, 60, 62 (key),  
72, 73, 74, 75, figs. 43-47, 49,  
50